



MAC4 Pipeline

Level 1 Vertebrate Fauna Assessment

BHP Western Australian Iron Ore

8 March 2019



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1	Tali Moyle	C. Knuckey, M. O'Connell	T. Carroll	05/02/2019
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3	Brighton Downing, Tali Moyle	T. Moyle	T. Carroll	8/03/2019

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EXECUTIVE SUMMARY

BHP Western Australian Iron Ore commissioned Biologic Environmental Survey Pty Ltd to undertake a Level 1 vertebrate fauna survey of two alternative pipeline routes north of Mining Area C (Study Area). The Study Area is located in tenement E52/3456-1 held by Hamersley Iron Ltd (part of the Rio Tinto Group) and is approximately 399 hectares in size. The reconnaissance survey was undertaken over three days between 20th and 22nd November 2018. The overarching objective of the assessment was to update information provided within previous fauna assessments and to assess the likelihood of significant conservation species and habitats occurring within the Study Area.

The vertebrate fauna desktop assessment was conducted via reviewing literature relevant to the Study Area and conducting several database searches. A total of 24 literature sources were reviewed and four databases were searched.

A total of four fauna habitats were recorded and mapped across the Study Area, comprising Hillcrest/ Hillslope, Drainage Area/ Floodplain, Minor Drainage Line and Gorge/ Gully. One of these habitats, Gorge/ Gully was considered high value for conservation significant species; two were considered to be of moderate value (Drainage Area/ Floodplain and Minor Drainage Line), while the remaining habitat was considered to be of low value.

The desktop assessment identified a total of 323 species of vertebrate fauna which have previously been recorded and/or have the potential to occur within the Study Area. This comprised 42 native mammals, nine non-native mammals, 149 birds, 112 reptiles, eight amphibians and three fish species. Of the 323 species of vertebrate fauna identified, 29 species are of conservation significance, comprising ten mammals, 16 birds and three reptiles. One species of conservation significance was confirmed as occurring within the Study Area during the survey, the Western Pebble-mound Mouse (*Pseudomys chapmani*).

Based on distribution, previous records and the habitats present, it is considered that the Ghost Bat (*Macroderma gigas*), Pilbara Barking Gecko (*Underwoodisaurus seorsus*) and the Peregrine Falcon (*Falco peregrinus*) are likely to occur within the Study Area. A further six species, the Northern Quoll (*Dasyurus hallucatus*), Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*), Grey Falcon (*Falco hypoleucos*), Northern Brushtail Possum (*Trichosurus vulpecula* subsp. *arnhemensis*), Flat-headed Blind Snake (*Anilius ganeī*) and the Pilbara Olive Python (*Liasis olivaceus barroni*) are considered possible to occur within the Study Area. One species, the Fork-tailed Swift (*Apus pacificus*), was deemed as rarely occurring across the Study Area. The remaining 18 were considered unlikely or highly unlikely to occur.

1 INTRODUCTION

1.1 Background

BHP Western Australian Iron Ore (BHP WAIO) commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake a single season Level 1 Fauna Assessment covering two proposed pipeline alignments near Mining Area C (hereafter referred to as the Study Area). The two pipeline alignments are located approximately 3 kilometres (km) apart, near the Hancock Range. The Study Area is located within the Pilbara bioregion and the Shire of East Pilbara (Figure 1.1). The Study Area is located approximately 2 km north west of the Mining Area C BHP mining operation (Figure 1.1) and 101 km northwest of the Newman township and covers an area of approximately 399 hectares (ha).

1.2 Objectives

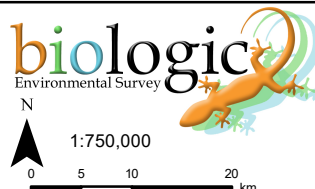
The overarching objective of this assessment was to identify the occurrence of vertebrate fauna habitats, fauna assemblages and the presence, or likely presence of fauna species of conservation significance. Specifically, this report provides:

- a review of vertebrate fauna recorded (through current database searches and recent surveys) within the Study Area and surrounding area and an update with regard to recent changes in taxonomy and conservation status;
- details of a baseline Level 1 survey for vertebrate fauna to determine vertebrate fauna occurring within the Study Area
- definition and delineation of broad fauna habitats occurring within the Study Area, and an assessment of their potential significance;
- an assessment on the presence, or likely presence, of vertebrate fauna currently considered to be of conservation significance (under state and federal legislation);



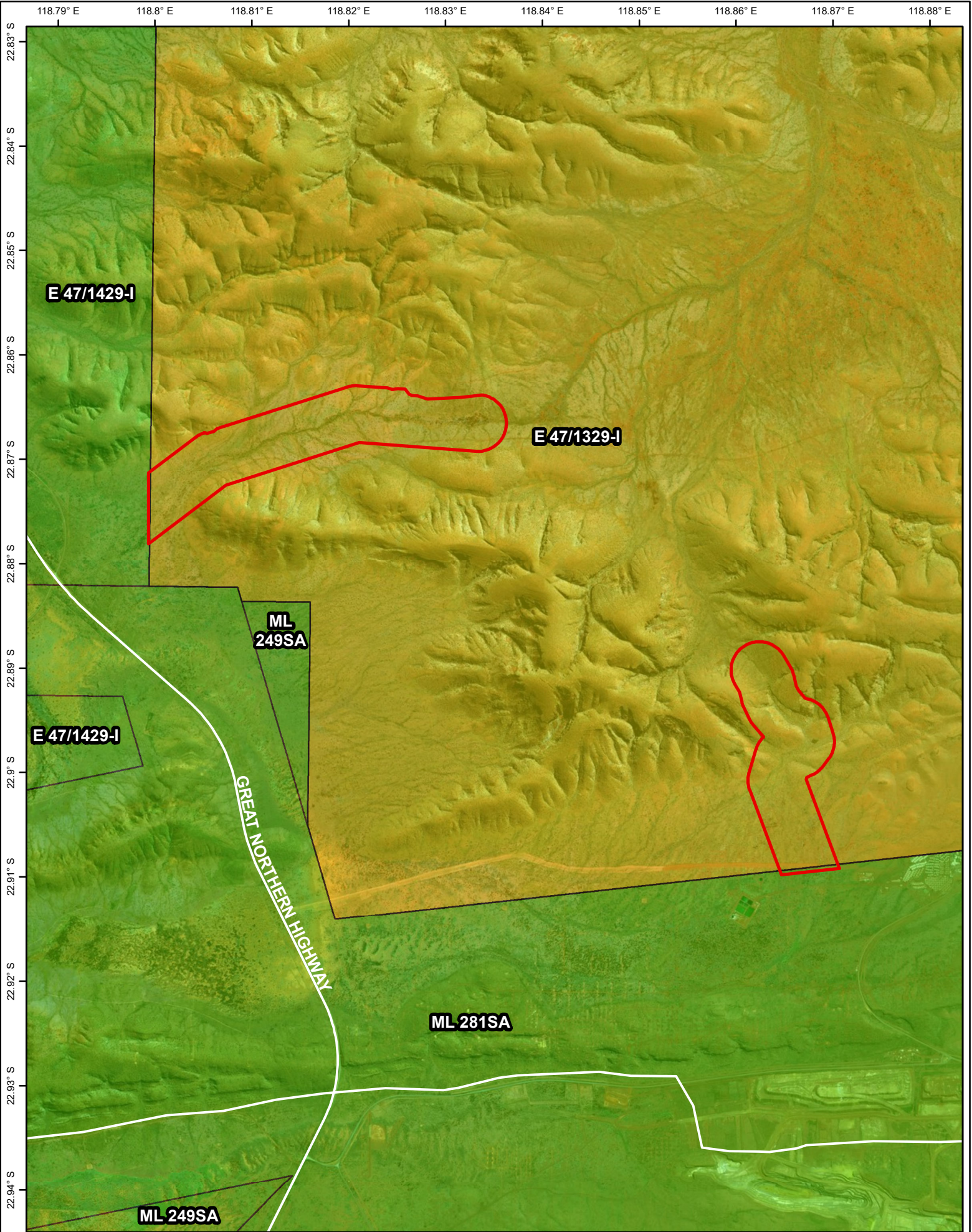
Legend

- Town
- Road
- + Railroad
- Local Government Area
- Reserve
- Study area
- IBRA Subregions
- Hamersley



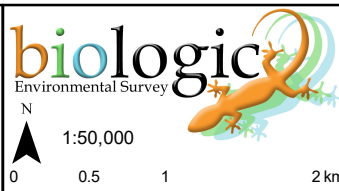
BHP Western Australian Iron Ore MAC4 Pipeline Fauna Survey Figure 1.1: Study area and regional location

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Size A4. Created 23/1/2019



Legend

-  Study area
-  BHP active tenements
-  Hamersley Iron Ltd (RioTinto)



**BHP Western Australian Iron Ore
MAC4 Pipeline Fauna Survey
Figure 1.2: Study Area and tenure**

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Size A4. Created 22/1/2019

1.3 Background to Protection of Fauna

Within Western Australia, native fauna are protected under the *Biodiversity Conservation Act 2016* (BC Act) and at a national level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action that has the potential to impact on native fauna needs to be approved by relevant state and/or federal departments as dictated by the state *Environmental Protection Act 1986* (EP Act).

Some species of fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are deemed to be of conservation significance. A summary of applicable legislation and status codes is provided in Table 1.1 and additional information on status codes is provided in Appendix A. A number of migratory bird species are also prioritised for conservation under international agreements and therefore protected under the EPBC Act and BC Act as Migratory.

For some species, there is insufficient information to determine their status. These species are generally considered by the Environmental Protection Agency (EPA) and the Department of Biodiversity, Conservation and Attraction's (DBCA) as being of conservation significance for all development related approvals and are listed on a 'Priority List' that is regularly reviewed and maintained by the DBCA (Table 1.1).

Table 1.1 Definitions and terms for fauna of conservation significance

Agreement, Act or List	Status Codes
Federal	
<i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i> The Department of the Environment and Energy (DoEE) lists threatened fauna, which are determined by the Threatened Species Scientific Committee (TSSC) per criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of seven categories (listed under 'Status Codes').	- Extinct (EX) - Extinct in the Wild (EW) - Critically Endangered (CR) - Endangered (EN) - Vulnerable (VU) - Conservation Dependent (CD) - Migratory (MI)
State	
<i>Biodiversity Conservation Act 2016 (BC Act)</i> At state level, native fauna are protected under the <i>Biodiversity Conservation Act 2016</i> . Species in need of conservation are given a ranking ranging from Critically Endangered to Vulnerable.	- Extinct (EX) - Extinct in the Wild (EW) - Critically Endangered (CR) - Endangered (EN) - Vulnerable (VU) - Migratory (MI) - Conservation Dependent Fauna (CD) - Other specially protected species (OS)
DBCA Priority List DBCA produces a list of Priority species that have not been assigned statutory protection under the <i>Wildlife Conservation Act 1950</i> . This system gives a ranking from Priority 1 to Priority 4.	- Priority 1 (Poorly-known species) (P1) - Priority 2 (Poorly-known species) (P2) - Priority 3 (Poorly-known species) (P3) - Priority 4 (Rare, Near Threatened, and other species in need of monitoring) (P4)

2 ENVIRONMENT

2.1 Biogeography

The Study Area is located in the southern section of the Pilbara Craton (Kendrick, 2001) in the Pilbara bioregion (Figure 1.1), as defined by the Interim Biogeographic Regionalisation of Australia (IBRA; Thackway & Cresswell, 1995). The Pilbara bioregion is characterised by vast coastal plains and inland mountain ranges with cliffs and deep gorges (Thackway & Cresswell, 1995). Vegetation is predominantly mulga low woodlands or snappy gum over bunch and hummock grasses (Bastin, 2008).

The Pilbara bioregion is characterised by four separate subregions, Chichester (PIL01), Fortescue (PIL02), Hamersley (PIL03) and Roebourne (PIL04), of which the Study Area is located within the Hamersley (PIL03) subregion (Figure 1.1). The Hamersley subregion is characterised by mountainous area of sedimentary ranges and plateaux, dissected by gorges (Kendrick, 2001). The Hamersley contains extensive open snappy gum woodland and hummock grassland communities on ranges and plateaux, with low mulga woodlands over bunch grasses on fine textured soils in lower areas and valley floors (Kendrick, 2001).

The significant and dominant feature of this subregion is the Hamersley Range. This prominent range feature, 450 km long, is a mountainous plateau which receives significantly higher rainfall than the surrounding subregion giving rise to deeply incised gorges, up to 100 metres (m) deep, containing extensive permanent spring-fed streams and pools (Kendrick, 2001). The Hamersley and Chichester Ranges drain to give rise to the Fortescue Marsh and Fortescue River systems (McKenzie *et al.*, 2002).

2.2 Climate

The Pilbara bioregion has a semi-desert to tropical climate, with rainfall occurring sporadically throughout the year, although mostly during summer (Thackway & Cresswell, 1995). Summer rainfall is usually the result of tropical storms in the north or tropical cyclones that impact upon the coast and move inland (Leighton, 2004). The winter rainfall is generally lighter and is the result of cold fronts moving north easterly across the state (Leighton, 2004). The average annual rainfall ranges from 200-400 millimetres (mm), although there are significant fluctuations between years (BoM, 2018), with up to 1200 mm falling in some locations in some years (McKenzie *et al.*, 2009). Annual rainfall on the Chichester and Hamersley Ranges increases to 400 mm (Tille, 2006).

Long-term climatic data is not available for the Study Area itself; however, long term climatic data is available from the Bureau of Meteorology (BoM) weather station at Newman Airport (Station 7176), 110 km southeast of the Study Area (BoM, 2018). Newman Airport is expected to provide the most accurate long-term average (LTA) dataset for climatic conditions experienced within the Study Area (Figure 2.1). Barimunya (station 505053) and Coondewanna (station 505051) are located closer to the Study Area, however these sites are relatively recent sites and long-term data is not yet available (BoM, 2018).

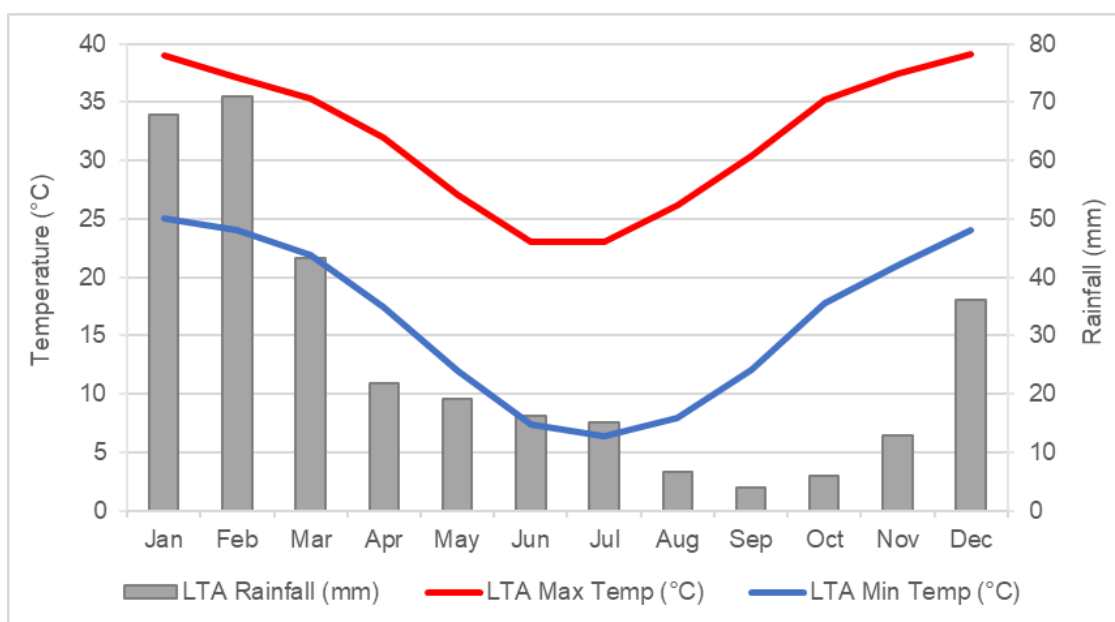


Figure 2.1: Long-term climatic averages (LTA) of monthly rainfall and temperature from Newman Airport (station 7176; BoM, 2018)

2.3 Vegetation

The Study Area is located in the Fortescue Botanical District, which is a part of the Eremaean Province (Beard, 1990). It is essentially a tree- and shrub-steppe with *Eucalyptus* spp. trees, *Acacia* shrubs, *Triodia pungens* and *Triodia wiseana* (Beard, 1990). Some mulga (*Acacia aneura* and close relatives) occurs in valleys and there are short-grass plains on alluvia (Beard, 1990). The vegetation associations of the Study area was mapped by Beard (1975), in which he classified the following two vegetation associations (Figure 2.2):

- 82: Hummock grasslands, low tree steppe; snappy gum (*Eucalyptus leucophloia*) over *Triodia wiseana*; and
- 18: Low woodland; mulga (*Acacia aneura* and close relatives) (with spinifex) on rises.

The northern portion of the Study Area was mapped as vegetation association 82, while the southern and far western portion of the Study Area was mapped as vegetation association 18 (Table 2.1, Figure 2.2).

Shepherd *et al.* (2002) attempted to reinterpret and update the vegetation association mapping to reflect the National Vegetation Information System (NVIS) standards (ESCAVI, 2003). The update also accounts for extensive clearing since Beard (1975) mapping. Shepherd *et al.* (2002) created a series of 'systems' to assist in removing mosaic vegetation associations originally mapped by Beard (1975); however, some mosaics still occur. The Study Area is located within the Hamersley System, as reinterpreted by Shepherd *et al.* (2002) (Table 2.1, Figure 2.2).

The current extent remaining of the vegetation system associations exceeds 98% across the four regional scales: State, bioregion (Pilbara), subregion (Hamersley) and Local Government Authority (Shire of East Pilbara) (DBCA, 2019) (Table 2.1). Currently both vegetation system associations (18 and 82) are represented within the National Reserve System having greater than 19% and 12%

(respectively) of their current bioregional and subregional extent within reserves (Government of Western Australia, 2018) (Table 2.1).

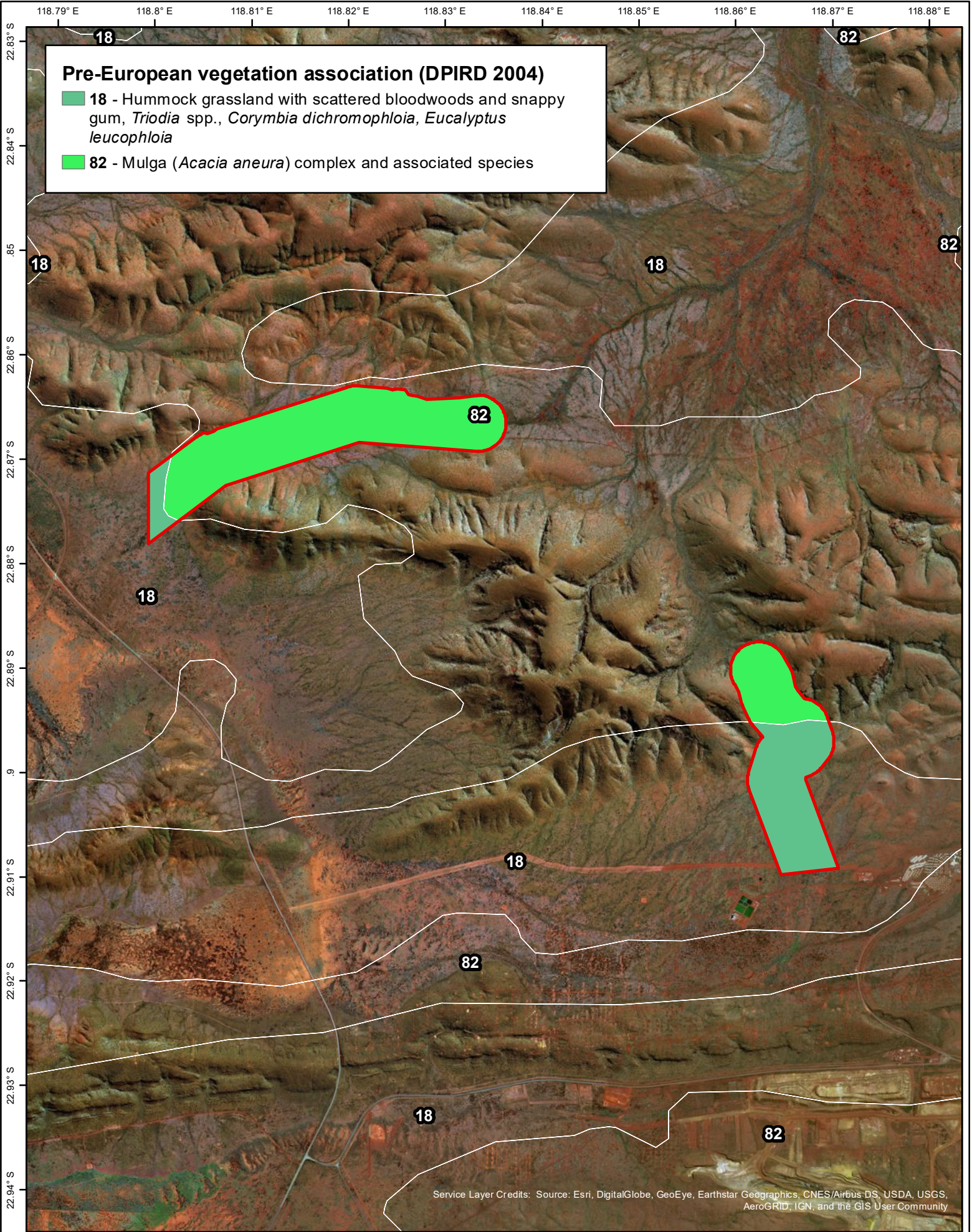
Table 2.1: Regional and local extent of the Hamersley System Associations within the Study Area

Code	Study Area (ha / %)	Scale	Pre-European extent (ha)	Current extent remaining (ha / %)	Current extent remaining within reserves (ha / %)
18	125 / 31	State	580,556	576,433 / 99.29	113,404 / 19.67
		Pilbara	580,512	576,389 / 99.29	113,404 / 19.54
		Hamersley	580,512	576,389 / 99.29	113,404 / 19.54
		LGA	224,292	220,375 / 98.25	44.4 / 0.02
82	274 / 69	State	2,169,997	2,157,852 / 99.44	262,983 / 12.19
		Pilbara	2,168,702	2,156,558 / 99.44	262,983 / 12.13
		Hamersley	2,158,862	2,146,719 / 99.44	262,244 / 12.15
		LGA	573,313	565,215 / 98.59	0 / 0

NB: LGA (Local Government Authority): Shire of East Pilbara

Reserves – International Union of Nature Conservation (IUCN) Class I-IV reserves (i.e. National Parks, Strict Nature Reserves)

Source: Government of Western Australia (2018); NB: area values have been rounded to the nearest whole number.



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus-DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend
Study area

biologic
Environmental Survey

N
1:50,000
0 0.5 1 2km

**BHP Western Australian Iron Ore
MAC4 Pipeline Fauna Survey**
**Figure 2.2: Pre-European vegetation
associations of the Study Area**

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Size A4. Created 22/1/2019

2.4 Land Systems

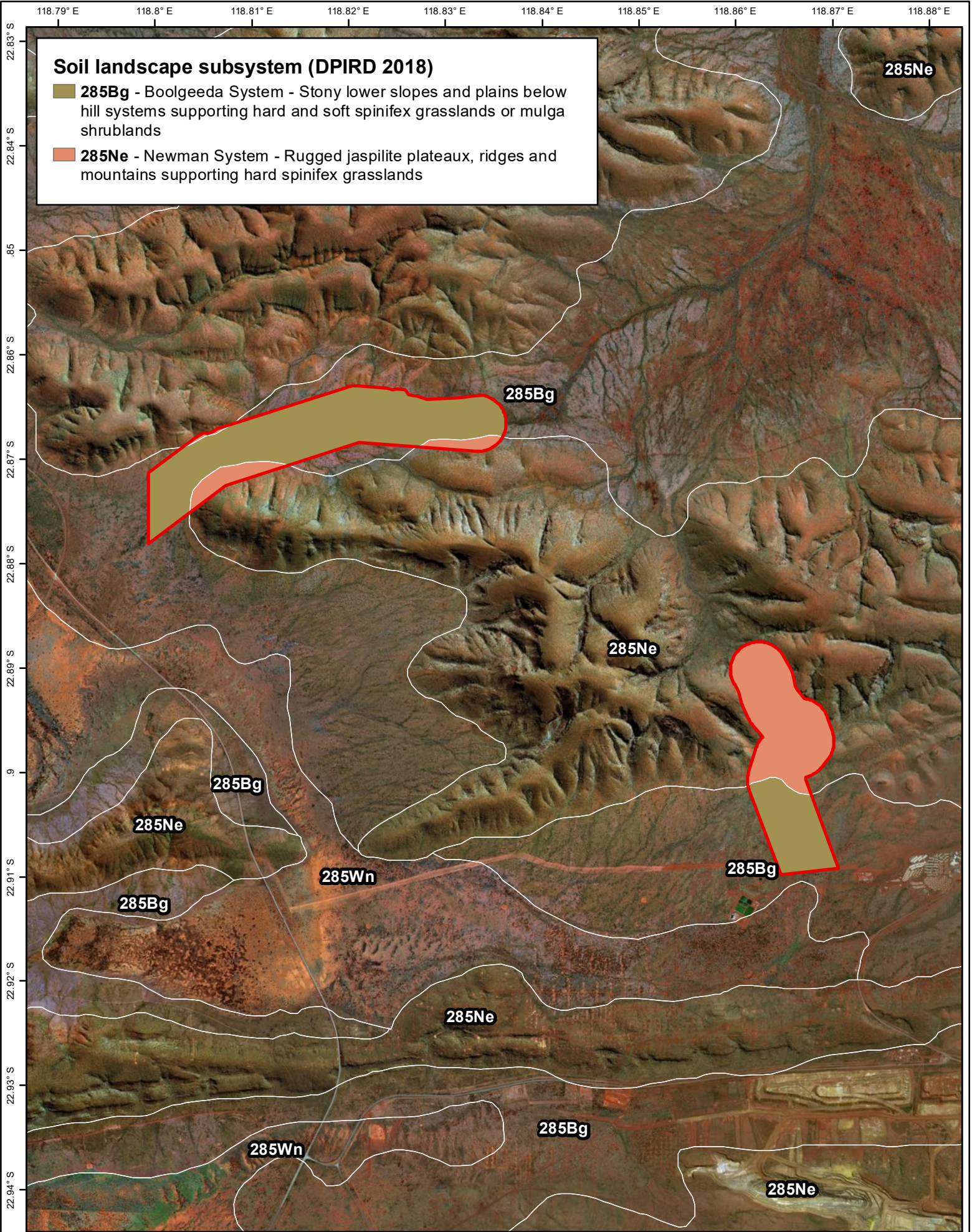
Work undertaken by a joint team from the (former) Department of Agriculture (now Department of Primary Industries and Regional Development) and the (former) Department of Lands Administration (now Department of Planning, Lands and Heritage) attempted to classify the pastoral areas of Western Australia (van Vreeswyk *et al.*, 2004). The purpose of the surveys were to provide a comprehensive description and mapping of the biophysical resources of the pastoral areas, together with an evaluation of the pastoral potential and the condition of the soils and vegetation (van Vreeswyk *et al.*, 2004).

Two land systems have been mapped as occurring across the Study Area, Boolgeeda and Newman (van Vreeswyk *et al.*, 2004) (Table 2.2; Figure 2.3). The dominant land system is the Boolgeeda land system, which covered approximately 67% of the Study Area (Table 2.2; Figure 2.3). The land type for the Boolgeeda land system is described as stony plains with spinifex grasslands. (Table 2.2; Figure 2.3).

Table 2.2 Land Systems of the Study Area

Land System	Land Type	Description	Extent in Study Area	
			Ha	%
Boolgeeda	Stony plains with spinifex grasslands	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands	265	67
Newman	Hills and ranges with spinifex grasslands	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands	133	33
Total			399	100

NB: hectare values have been rounded to the nearest whole number.



Soil landscape subsystem (DPIRD 2018)

- 285Bg** - Boolgeeda System - Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands
- 285Ne** - Newman System - Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands

Legend

 Study area

biologic
Environmental Survey



N
1:50,000
0 0.5 1 2km

**BHP Western Australian Iron Ore
MAC4 Pipeline Fauna Survey
Figure 2.3: Land systems of
the Study Area**

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Size A4. Created 22/1/2019

3 METHODOLOGY

3.1 Compliance

The survey was carried out in a manner consistent with the Western Australian Environmental Protection Authority (EPA), DBCA, Department of the Environment and Energy (DoEE), and BHP guidelines for the environmental surveying and reporting of fauna.

- BHP (2017) Guidance for Terrestrial Vertebrate Fauna Surveys in the Pilbara
- EPA (2018) Statement of Environmental Principles, Factors and Objectives;
- DEWHA (2010a) Survey Guidelines for Australia's Threatened Bats;
- DEWHA (2010b) Survey Guidelines for Australia's Threatened Birds;
- DEWHA (2010b) Survey Guidelines for Australia's Threatened Frogs;
- DSEWPaC (2011a) Survey Guidelines for Australia's Threatened Mammals;
- DSEWPaC (2011b) Survey Guidelines for Australia's Threatened Reptiles;
- EPA (2016a) Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna
- EPA (2016b) Technical Guidance: Terrestrial Fauna Surveys
- DPaW (2017) Interim guidelines for the preliminary surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia;
- (DoE, 2016) EPBC Act referral guideline for the endangered Northern Quoll (*Dasyurus hallucatus*)

3.2 Desktop Assessment

3.2.1 Literature Review

A review of all available literature relevant to the Study Area was undertaken to compile a list of vertebrate fauna species with the potential to occur within the Study Area. A total of 24 assessments were reviewed, comprising 15 Level 2 surveys, five Level 1 Surveys and four targeted (Table 3.1).

Table 3.1 Literature sources used for the review

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Overlapping/ borders the Study Area			
Mining Area C Biological Survey	Ecologia (1998a)	Level 2	Overlaps
Area C Mining Operation Environmental Management Plan (Revision 4) A, D, P1 and P3 Deposits: Bat Survey and Assessment	Specialised Zoological (2008)	Targeted	Overlaps
Area C and Surrounds Vertebrate Fauna Survey	Biologic (2011a)	Level 2	Borders
Area C West Vertebrate Fauna Survey	Biologic (2013)	Level 2	Borders

Survey Title	Reference	Survey Type	Distance from Study Area (km)
Surveys in the immediate area (at least part of survey within 10 km of the Study Area)			
Packsaddle West Vegetation and Flora Survey and Fauna Assessment	Astron (2010b)	Level 1	~0.5km S
Pilbara Region Ghost Bat Population and Roost Assessment: 2016 - 2017	Biologic (<i>in prep.</i>)	Targeted	~1km W
Area C Packsaddle Range Biological Survey	Ecologia (2004b)	Level 2	~1km S
Area A and Additional Areas Level 2 Terrestrial Fauna Survey	Ecologia (2008)	Level 2	~1km W
Area C Deposits D, E and F Biological Survey	Ecologia (2004a)	Level 2	~2km S
Mining Area C Expansion Deposit E Bat Assessment	(Ecologia, 2005b)	Targeted	~4km S
Southern Flank Vertebrate Fauna Study	Biologic (2011d)	Level 2	~5km S
South Flank Targeted	Biologic (2016)	Targeted	~5km S
Area C South Flank Deposit Fauna Assessment	ENV (2008a)	Level 1	~8km S
Regional surveys (greater than 10 km from the Study Area)			
Area C Deposit A, D, P1 and P3 Vertebrate Fauna Survey	Outback Ecology (2008)	Level 2	~12km SEE
Area C Deposit R Fauna Assessment	ENV (2007)	Level 2	~13km SE
Area C West Fauna Assessment	ENV (2008b)	Level 2	~14km SW
Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment	ENV (2009)	Level 1	~19km E
Mudlark Well Exploration Project Biological Survey	Ecologia (2005a)	Level 2	~19km SW
Area C to Jinayri to Mount Newman Railway*	Outback Ecology (2010)	Level 2	~20km E to 65km NE
Ministers North Biological Survey	Ecologia (2006)	Level 1	~22km E
Weeli Wolli Creek Biological Assessment Survey	(Ecologia, 1998b)	Level 2	~29km SEE
Jinidi to Mainline Vertebrate Fauna Survey	Biologic (2011b)	Level 2	~34km E
Jinayri Vertebrate Fauna Assessment	ENV (2008c)	Level 2	~36km E
Jinidi Vertebrate Fauna Survey	Biologic (2011c)	Level 1	~36km E

3.2.2 Database Searches

Four fauna databases were searched (Table 3.2), two to obtain information on all species previously recorded (NatureMap and occurrence search), one to identify species of conservation significance previously recorded (DBCA Threatened Fauna Database), and one to identify species of conservation significance known or likely to occur within the region (Protected Matters Database).

Table 3.2: Details of database searches conducted

Provider	Reference	Database	Parameters
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2019)	NatureMap. Accessed 2 November 2018	Circle of radius 40 km centred on the coordinates: 22° 52' 47" S, 118° 50' 26" E,
Department of Biodiversity, Conservation and Attractions (DBCA)	(DBCA, 2018)	Threatened Fauna Database. Received 14 November 2018	Circle of radius 40 km centred on the coordinates: 22°52'46.69"S; 118°50'25.84"E
Department of the Environment and Energy	DoEE (2018)	Protected Matters Search (MNES)	Circle of radius 40 km centred on the coordinates: 22°52'46.69"S; 118°50'25.84"E
Atlas of Living Australia	ALA (2018)	Occurrence search	Circle of radius 10 km centred on the coordinates: 22°52'46.69"S; 118°50'25.84"E 23°25'39.67"S; 119°36'53.45"E

3.3 Field Survey

3.3.1 Survey Type, Timing and Weather

A single season fauna assessment was requested by BHP and was deemed to be the most appropriate survey methodology, considering the timing of the survey (i.e. November 2018) and the scope. The field survey was undertaken over three days, between 20th and 22nd November 2018. The daytime climatic conditions during the field survey (hot temperatures with clear skies, BoM, 2018) were adequate to complete the survey with minimal constraints and limitations.

The field survey was undertaken following a summer, autumn and winter season of large fluctuations. The months of January and February 2018 received substantial rainfall (238 mm at Barinmunya [weather station 505053] and 293 mm at Coondewanna [weather station 505051], Figure 3.1) (BoM, 2018). The months of February to May received low rainfall (30 mm at Barimunya and 38 mm at Coondewanna; Figure 3.1). The month of June, received unseasonally high rainfall (32 mm at Barimunya and 34 mm at Coondewanna; Figure 3.1), while the four months preceding the field survey (July to October) recorded minimal rainfall (1.2 mm at Barimunya and 0.6 mm at Coodenwana; Figure 3.1) (BoM, 2018). Although the Study Area would have received substantial rainfall during 2018, the four months of hot and dry weather ensured that there was no soil moisture, which was evident by the lack of annuals and ephemerals, while a number of perennial grasses had only vegetative material present. The monthly long-term average rainfall for the Newman Airport weather station (number 7176) is included in Figure 3.1 for comparison.

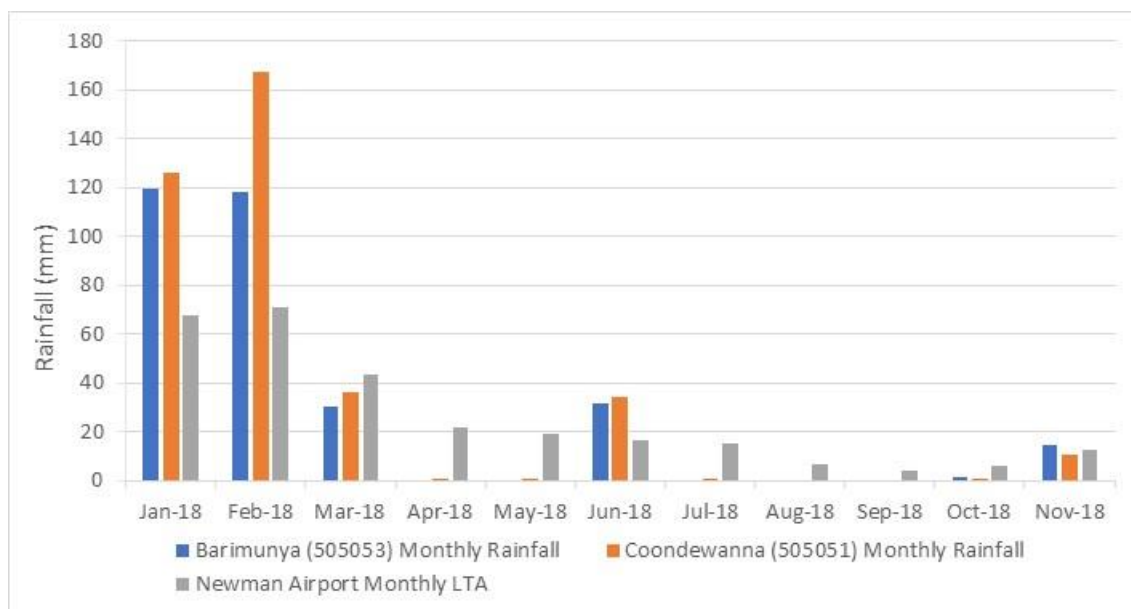


Figure 3.1: 2018 monthly rainfall for Barimunya and Coondewanna and the long-term average (LTA) rainfall for Newman Airport for comparison (BoM, 2018)

3.3.2 Survey Team and Licensing

The field survey was led by Principal Ecologist Mr Morgan O'Connell whom has over 15 years' experience surveying vertebrate fauna within the Pilbara region. Morgan was assisted in the field by Senior Botanist Mr Clinton van den Bergh, whom has over 11 years' experience conducting flora and fauna surveys in the Pilbara region. The survey was conducted under the Department of Biodiversity, Conservation and Attractions (DBCA) Regulation 17 license 08-003289-1 issued to Chris Knuckey.

3.3.3 Habitat Assessments and Mapping

Habitat assessments were undertaken at 53 locations across the Study Area. (Figure 3.2, Appendix C). Habitats in the Study Area were assessed using methodology and terminology modified from the *Australian Soil and Land Survey Field Handbook* (National Committee on Soil and Terrain, 2009). The characteristics recorded during the habitat assessments were:

- site information, photo and location;
- landform: slope, relative inclination of slope, morphological type and landform type;
- vegetation: leaf litter %, twig litter %, wood litter, dead stags and hollow bearing trees, broad floristic formation, vegetation structure (tall, mid and low), and dominant species;
- land surface: micro relief, sheet erosion, rill erosion, gully erosion, gully depth, abundance and size of coarse fragments, rock outcropping, water bodies, comments on nests, burrows, roosts and diggings;
- soil: texture, colour;
- substrate: bare ground, rock size, rock type, rock outcropping; and
- disturbance: time since last fire, evidence of weeds, grazing, or human disturbances.

Fauna habitats were assessed for the likelihood that they may support conservation significant fauna. All major fauna habitats present within the Study Area were rated (High, Moderate or Low) per the criteria in **Table 3.3**.

Table 3.3 Fauna habitat significance assessment criteria

Score	Possible criteria (score results from any possible criterion being met)
High	Fauna listed as threatened under the EPBC Act or BC Act have been recorded from this habitat type within the Assessment Areas.
	Habitat known to be suitable core habitat for EPBC Act and/or BC Act listed threatened fauna, and there are records of this species within 40 km ² . Core habitat is defined as containing the critical habitat elements for survival and reproduction of a species (Bingham & Noon, 1997).
	Habitat is regionally uncommon or limited in extent and known to support species listed as: - Threatened fauna under the EPBC Act and/or BC Act, but it is not their core habitat (e.g., may be used periodically/ seasonally or for dispersal). - Species of Special Conservation Interest or Other Specially Protected Species under the BC Act. - DBCA listed Priority fauna, which are known to be solely reliant on this habitat.
Moderate	Habitat known to support EPBC Act and/or BC Act listed Migratory fauna.
	Habitat that is regionally uncommon (e.g., occurs in small and isolated areas) and supports a particularly diverse and uncommon faunal assemblage.
	Habitat is common and widespread and known to support species listed as: - Threatened fauna under the EPBC Act and/or BC Act, but it is not their core habitat (e.g., may be used periodically/ seasonally or for dispersal). - Species of Special Conservation Interest or Other Specially Protected Species under the BC Act - DBCA listed Priority fauna, which are known to be solely reliant on this habitat.
Low	Habitat is widespread/common and does not solely support any DBCA listed Priority fauna.

3.3.4 Targeted Searches

Targeted searches were undertaken to identify the occurrence of fauna of conservation significance and to search for important habitat features, such as water features and caves. Targeted searches were conducted within the most prospective areas in terms of habitat features and habitats suitable for species of conservation significance. During the targeted searches, and while traversing the Study Area, the team recorded all vertebrate fauna species of conservation significance encountered, either from primary (i.e. direct observation) or secondary (e.g. burrows, scratching's, diggings and scats) evidence.

3.3.5 Opportunistic Vertebrate Fauna Records

Opportunistic records of vertebrate species encountered during the survey were documented. Birds were recorded on a presence/absence basis, determined by call identification, visual identification and/or tracks and traces.

3.3.6 Taxonomy and Nomenclature

BHP's checklist of vertebrate fauna was followed for nomenclature and taxonomy of mammal, birds, reptile and amphibian. This list broadly follows the latest checklist published by the Western Australian

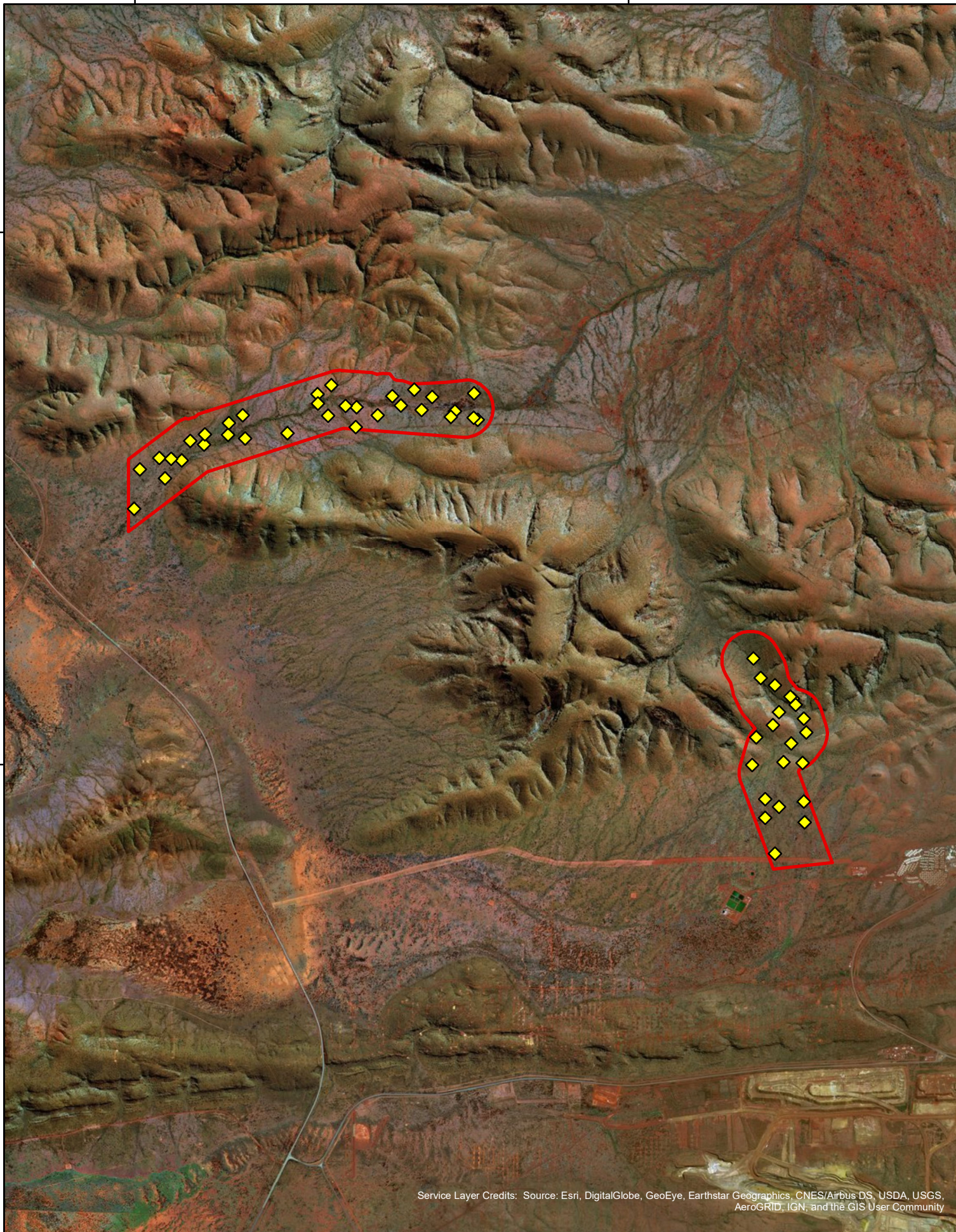
Museum (WAM, 2018) (for mammals, reptiles and amphibians), and the current checklist of Australian birds maintained by Birds Australia (based on, Christidis & Boles, 2008).

118.8° E

118.85° E

22.85° S

22.9° S

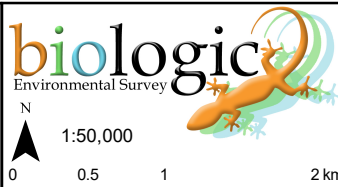


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Study area

◆ Vertebrate fauna habitat assessment site



1:50,000

0

0.5

1

2 km

BHP Western Australian Iron Ore

MAC4 Pipeline Fauna Survey

Figure 3.2: Survey sampling locations

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A4. Created 19/2/2019

3.4 Assessment on Occurrence

Conservation significant fauna species recorded from the databases and previous reports were assessed for their likelihood to occur within the Study Area using the decision matrix below (Table 3.4).

Table 3.4: Species likelihood of occurrence decision matrix

Range categories:	Habitat Categories				
	Core habitat known to occur	Foraging habitat known to occur	Dispersal habitat known to occur	Potential dispersal habitat	No known habitat occurs
Species recorded <5 km	Highly Likely	Likely	Likely	Possible	Possible
Species recorded 5-10 km	Likely	Likely	Possible	Possible	Rarely
Species recorded 10-40 km	Likely	Possible	Possible	Rarely	Unlikely
Species recorded >40 km	Possible	Possible	Rarely	Rarely	Unlikely
Species rarely recorded in region	Possible	Rarely	Unlikely	Unlikely	Highly Unlikely

This decision matrix is only intended to be an indicative guide, and was applied with the following considerations:

- The range categories are subject to interpretation based on the known range of each species and its natural dispersal capabilities (for example, >50 km range may be a significant distance for a fossorial skink, but not a migratory bird);
- Both the range categories and the habitat categories can vary markedly for different types of fauna such as birds, reptiles, mammals, and amphibians, and fauna with different ecological niches within each of these groups;
- The degree of habitat specificity for each species is a major determining factor for each of the habitat categories, and this in turn is dependent on the current state of ecological knowledge of the species.
- The amount and location of previous sampling is a major factor influencing the applicability of the range categories, as well as the amount of effort that has been expended in (and the accessibility of) the area in question for sampling;
- The current state of taxonomy is another major factor for species that are poorly known taxonomically and thus difficult to identify accurately, as well as for any recent changes of classification and/or conservation category. Such taxonomic changes can affect the reliability of previous records within fauna databases, the conservation status of the newly defined species/ populations, and the assumptions regarding species ranges and habitat preferences; and
- The language used in each of the habitat and range categories may be useful for some taxa and not for others (for example, 'rarely' occurrences may be useful for describing birds or fauna

which can traverse large distances, but in the case of fauna with more limited dispersal capabilities such as reptiles, there is no basis for 'rarely' occurrences. Such likelihoods may be more likely to represent range extensions.

3.5 Potential Limitation and Constraints

The EPA (2016b) outlines several potential limitations to fauna surveys. These aspects are assessed and discussed in Table 3.5 below.

Table 3.5: Survey limitations and constraints

Limitation or constraint category	Potential limitation or constraint	Applicability to this survey
Experience of personnel.	No	The field personnel involved in the survey each have more than 10 years of survey experience in the Pilbara. The field survey was led by Morgan O'Connell whom has vast experience surveying fauna in the immediate vicinity of the Study Area.
Scope (faunal groups sampled and whether any constraints affect this)	No	The scope was a Level 1 survey and was conducted within that framework. The primary objective of a Level 1 fauna survey is to verify the results of the desktop assessment and characterise fauna habitats and assemblages, which was successfully done during this survey
Proportion of fauna identified	No	Compiling a species list of fauna occurring in the Study Area was not a key objective of the survey. Although all fauna recorded were identified at the point of observation.
Sources of information (recent or historic) and availability of contextual information	No	The Study Area is located immediately north of the Mining Area C mine operated by BHP. An extensive amount of biological survey work has occurred across Mining Area C, all of which were available for this assessment. A total of 24 fauna assessments were reviewed to characterise the fauna habitats and assemblages likely to occur in the Study Area.
Proportion of the task achieved	No	A Level 1 survey of the Study Area was completed as per relevant guidelines
Disturbances (e.g. fire or flood)	No	Recent fire was evident through much of the Study Area. This would have impacted on the presence of fauna species as well as the associated fauna assemblages. However, the presence of fire did not impact on the ability to characterise the fauna habitats and assemblage, as was the key objective of a Level 1 survey.
Timing (e.g. weather, season, cycle)	No	Although the Study Area would have received substantial rainfall during 2018, the four months preceding the field survey (July to October) recorded minimal rainfall. The day time climatic conditions during the field survey (hot temperatures with clear skies, BoM, 2018) were adequate to complete the survey with minimal constraints and limitations.
Intensity of survey	No	A Level 1 and targeted survey was identified by BHP as the requirement for this survey. The Study Area was traversed and surveyed on foot with all major habitats visited. The Study Area is 398 ha in size and it was not feasible to traverse the entire Study Area. As the survey intensity was set at a Level 1, this is not considered to be a constraint.

Limitation or constraint category	Potential limitation or constraint	Applicability to this survey
Completeness of survey	No	The survey was adequately completed to meet the requirements of a Level 1 survey.
Resources (e.g. degree of expertise available)	No	All resources required to complete the survey were available.
Remoteness or access issues	No	The Study Area was accessed via mining, exploration and pastoral tracks. Minor tracks were limited in the Study Area. As such, portions of the Study Area were not traversed due access and distance from vehicle restrictions. However, this is not considered to be a constraint due to the survey type (Level 1) employed for the Survey.

4 RESULTS AND DISCUSSION

4.1 Desktop Assessment

The literature review and database searches identified a total of 320 species of vertebrate fauna, which have previously been recorded and/ or have the potential to occur within (40 km) the Study Area. This comprised 42 native mammals, nine non-native mammals, 149 birds, 112 reptiles and eight amphibians (Table 4.1, Appendix B). Note that some of these species are unlikely to occur in the Study Area as the database searches were undertaken over a larger area than the Study Area itself, therefore containing habitats that do not necessarily occur within the Study Area. Additionally, many species tend to be patchily distributed even where appropriate habitats are present, and many species of birds can occur as regular migrants, occasional visitors or vagrants.

Of the 320 species of vertebrate fauna identified as being previously recorded and/ or having the potential to occur, 29 species are of conservation significance, comprising 10 mammals, 16 birds and three reptiles (Table 4.2). Nine species of conservation significance have previously been recorded within 40 km of the Study Area and these locations are shown within Figure 4.1.

Table 4.1: Summary of fauna species recorded or reported from desktop assessment

Source	Reference	Native Mammals	Introduced Mammals	Birds	Reptiles	Amphibians	Total species
Literature Sources							
Mining Area C Biological Survey	Ecologia (1998a)	16	3	80	40	2	141
Area C Mining Operation Environmental Management Plan (Revision 4) A, D, P1 and P3 Deposits: Bat Survey and Assessment	Specialised Zoological (2008)	6	0	0	0	0	6
Area C and Surrounds Vertebrate Fauna Survey	Biologic (2011a)	22	3	76	60	4	165
Area C West Vertebrate Fauna Survey	Biologic (2013)	25	5	98	81	3	212
South Flank Targeted	Biologic (2016)	5	3	4	3	0	15
Packsaddle West Vegetation and Flora Survey and Fauna Assessment	Astron (2010b)	8	2	62	14	0	86
Pilbara Region Ghost Bat Population and Roost Assessment: 2016 - 2017	Biologic (<i>in prep.</i>)	1	0	0	0	0	1
Area C Packsaddle Range Biological Survey	Ecologia (2004b)	9	1	55	20	0	85
Area A and Additional Areas Level 2 Terrestrial Fauna Survey	Ecologia (2008)	19	2	65	36	0	6

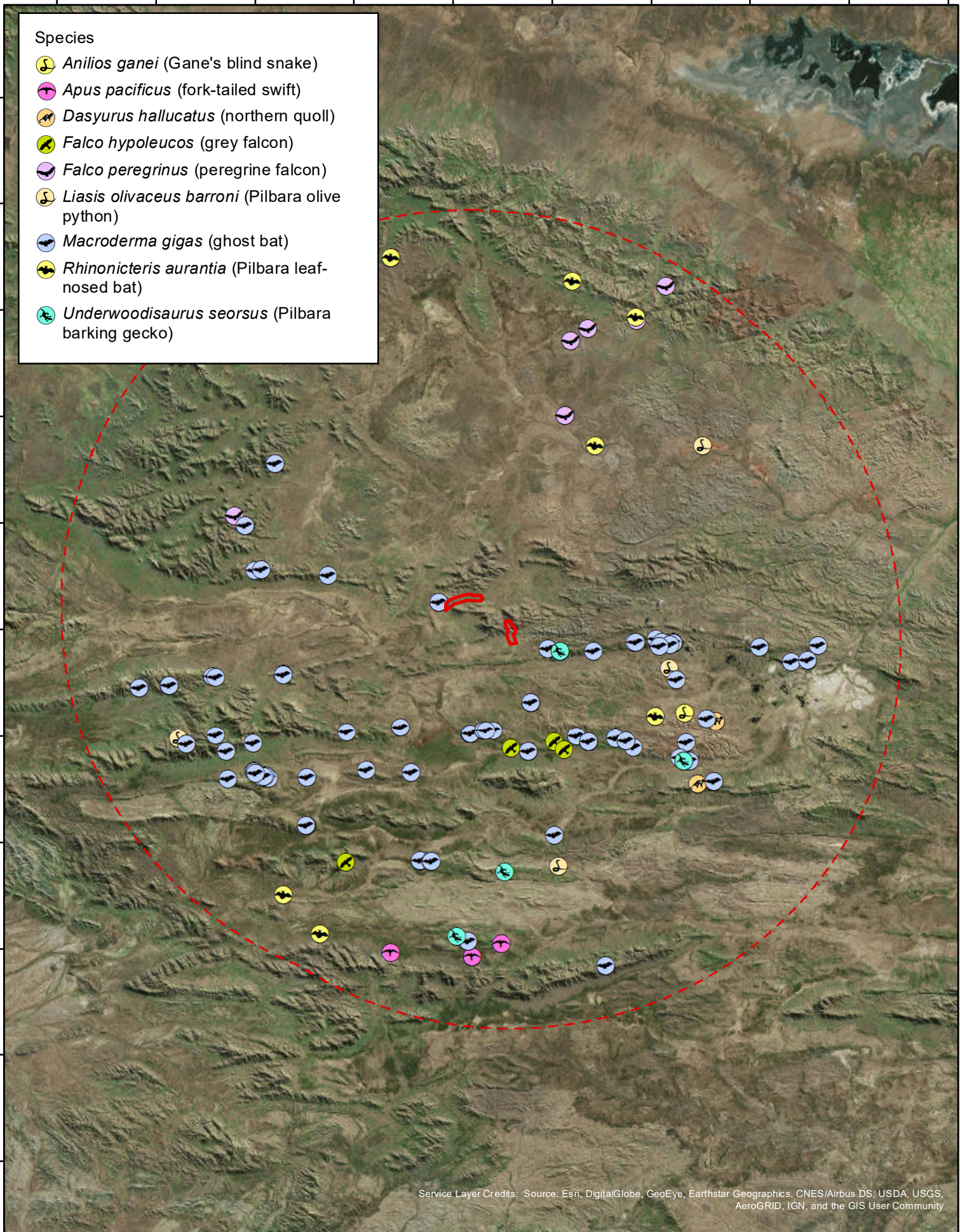
Source	Reference	Native Mammals	Introduced Mammals	Birds	Reptiles	Amphibians	Total species
Area C Deposits D, E and F Biological Survey	Ecologia (2004a)	15	2	55	32	0	104
Mining Area C Expansion Deposit E Bat Assessment	(Ecologia, 2005b)	2	0	0	0	0	2
Southern Flank Vertebrate Fauna Study	Biologic (2011d)	26	7	68	58	2	161
Area C South Flank Deposit Fauna Assessment	ENV (2008a)	13	4	56	23	4	100
Area C Deposit A, D, P1 and P3 Vertebrate Fauna Survey	Outback Ecology (2008)	8	3	61	26	2	100
Area C Deposit R Fauna Assessment	ENV (2007)	14	0	68	25	1	108
Area C West Fauna Assessment	ENV (2008b)	18	2	72	31	1	124
Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment	ENV (2009)	3	3	59	9	0	74
Mudlark Well Exploration Project Biological Survey	Ecologia (2005a)	9	1	30	18	0	58
Area C to Jinayri to Mount Newman Railway*	Outback Ecology (2010)	19	6	95	74	4	198
Ministers North Biological Survey	Ecologia (2006)	12	0	42	18	1	73
Weeli Wolli Creek Biological Assessment Survey	(Ecologia, 1998b)	10	3	84	30	3	130
Jinidi to Mainline Vertebrate Fauna Survey	Biologic (2011b)	27	4	89	68	4	192
Jinayri Vertebrate Fauna Assessment	ENV (2008c)	21	5	65	60	1	152
Jinidi Vertebrate Fauna Survey	Biologic (2011c)	13	2	59	16	2	92
Database Searches							
NatureMap		34	8	112	95	7	256
Protected Matters		4	0	12	1	0	17
DBCA Threatened Fauna		6	0	4	4	0	14
Atlas of Living Australia		8	0	56	39	2	105
Total Species		42	9	149	112	8	320
Species of Conservation Significance		10	-	17	3	0	30

Totals include species omitted from further consideration, as discussed below.

118.4° E 118.5° E 118.6° E 118.7° E 118.8° E 118.9° E 119° E 119.1° E 119.2° E 119.3° E

Species

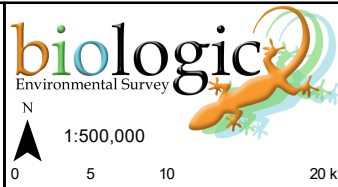
-  *Anilius ganeii* (Gane's blind snake)
-  *Apus pacificus* (fork-tailed swift)
-  *Dasyurus hallucatus* (northern quoll)
-  *Falco hypoleucos* (grey falcon)
-  *Falco peregrinus* (peregrine falcon)
-  *Liasis olivaceus barroni* (Pilbara olive python)
-  *Macroderma gigas* (ghost bat)
-  *Rhinonictes aurantia* (Pilbara leaf-nosed bat)
-  *Underwoodisaurus seorsus* (Pilbara barking gecko)



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Legend

-  Study area
-  40 km buffer



BHP Western Australian Iron Ore MAC4 Pipeline Fauna Survey Figure 4.1: Database search results

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A4. Created 23/1/2019

Table 4.2: Species of conservation significance identified and their conservation status

Common Name	Scientific Name	Current Conservation Status			
		EPBC Act	BC Act	DBCA	IUCN
Mammals					
<i>Dasyurus hallucatus</i>	Northern Quoll	EN	EN		EN
<i>Macrotis lagotis</i>	Bilby, Dalgyte	VU	VU		VU
<i>Macroderma gigas</i>	Ghost Bat	VU	VU		VU
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	VU	VU		
<i>Trichosurus vulpecula</i> subsp. <i>arnhemensis</i>	Northern Brushtail Possum		VU		
<i>Dasycercus blythi</i>	Brush-tailed Mulgara			P4	
<i>Leggadina lakedownensis</i>	Short-tailed Mouse			P4	
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse			P4	
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P4	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Locally Significant			
Birds					
<i>Calidris ferruginea</i>	Curlew Sandpiper	CR/MG	CR/MI		NT
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR		EN
<i>Rostratula benghalensis</i> subsp. <i>australis</i>	Australian Painted Snipe	EN	EN		
<i>Falco hypoleucos</i>	Grey Falcon		VU		VU
<i>Apus pacificus</i>	Fork-tailed Swift	MG	MI		
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MG	MI		
<i>Calidris melanotos</i>	Pectoral Sandpiper	MG	MI		
<i>Charadrius veredus</i>	Oriental Plover	MG	MI		
<i>Hirundo rustica</i>	Barn Swallow	MG	MI		
<i>Motacilla cinerea</i>	Grey Wagtail	MG	MI		
<i>Motacilla flava</i>	Yellow Wagtail	MG	MI		
<i>Pandion haliaetus</i>	Eastern Osprey	MG	MI		
<i>Tringa glareola</i>	Wood Sandpiper	MG	MI		
<i>Tringa hypoleucos</i>	Common Sandpiper	MG	MI		
<i>Tringa nebularia</i>	Common Greenshank	MG	MI		
<i>Falco peregrinus</i>	Peregrine Falcon		OS		
Reptiles					
<i>Liasis olivaceus</i> subsp. <i>barroni</i>	Pilbara Olive Python	VU	VU		
<i>Anilius ganei</i>				P1	
<i>Underwoodisaurus seorsus</i>	Pilbara Barking Gecko			P2	

4.2 Fauna Habitats

A total of four broad fauna habitat types were recorded and mapped across the Study Area. This comprised, in decreasing order of extent, Hillcrest/ Hillslope, Drainage Area/ Floodplain, Minor Drainage Line, Gorge/ Gully. Additionally, there was also a cleared/ disturbed area (Figure 4.2) (Table 4.3).

Descriptions of the distinguishing characteristics and the occurrence inside and outside of the Study Area for each of these habitat types are presented in (Table 4.3), and the data from on-site habitat assessments are presented in (Appendix C)

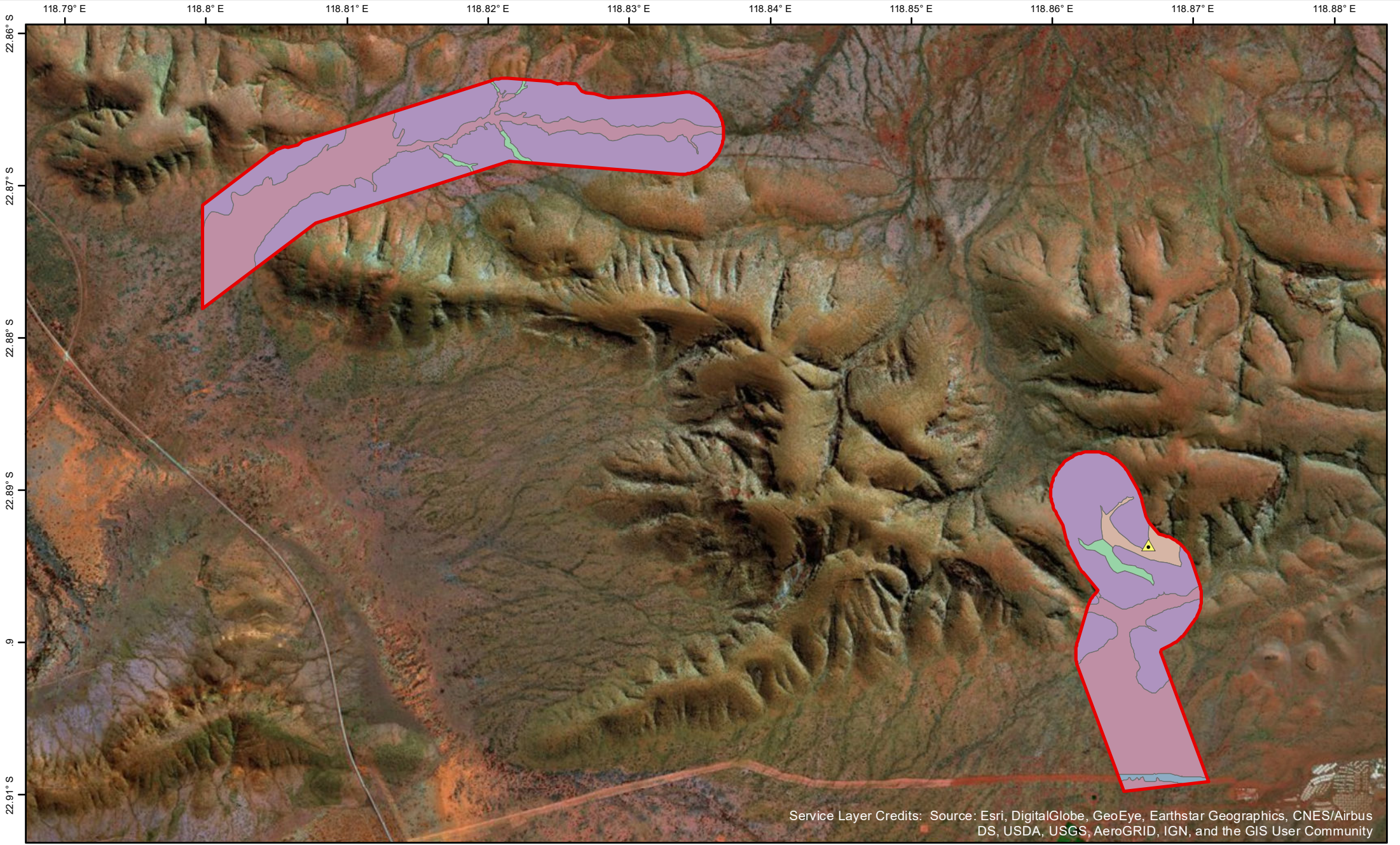
The majority of the Study Area, except some of the Gorge/Gully and lower flood plain areas, was subjected to a wildfire within the last 24 months, with the majority of the vegetation scorched. This was evident on the hills and hillslopes where vegetation was observed recovering with minimal vegetative growth. Smaller portions of the western end of the Study Area were also subjected to a wildfire in the last four years.

Table 4.3: Fauna habitat descriptions

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Photo
Hillcrests/ Slopes 235.8 ha 59.2% Significance: Low	This habitat type comprises hills and undulating plains on the tops of ranges, supporting hard spinifex with a mantle of gravel and pebbles. Vegetation was dominated by a <i>Triodia</i> hummock grassland with scattered <i>Eucalyptus leucophloia</i> trees and other occasional Eucalypts and Acacia and <i>Senna</i> shrubs. The primary microhabitat is the spinifex hummocks. This habitat was differentiated from the remaining habitat by the lack of rocky outcropping and shade gullies and lack of vegetation diversity.	This habitat type was the most widespread and dominant habitat within the Study Area. The habitat comprised the large ranges, characteristic of the region and was intersected by drainage lines. The Hillcrests and Slopes habitat is a characteristic habitat type of the Pilbara region. This Habitat type with its composition of biota is uncommon outside the Pilbara. The flora and fauna which comprise this habitat are similar to those that occur in the Plains habitats which occur at lower altitudes and are common throughout the region. As such the fauna which occupy this habitat type are generally common, widespread at a regional level and are well represented within the region's conservation estate.	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Photo
Drainage Area/ Floodplain 144.6 ha 36.3 % Significance: Moderate	Densely vegetated plains occurring on low-lying alluvial plains, with a moderate-high amount of leaf litter and woody debris. Vegetation was dominated by a <i>Themeda</i> tussock grassland with other tussock grasses (including significant covers of Buffel Grass) and scattered Eucalypts and a range of dominating tall shrubs <i>Acacia</i> shrubs (including some mulga) and mid <i>Eremophila</i> shrubs.	This habitat type was located in the western section of the northern polygon and the southern section of the southern polygon in the Study Area. These areas were associated with drainage from the Hillcrest/ Hillslopes and ranges throughout the Study Area. The northern portion of this habitat is associated with the widening of the east-west minor drainage as well as drainage from the surrounding range Drainage Area/ Floodplains are common throughout the Pilbara region due to the topography of the region. As with most drainage systems, this habitat is well connected within the landscape.	
Minor Drainage Line 6.4 ha 1.6 % Significance: Moderate	The vegetation of this habitat type comprised dense stands of shrubs, often <i>Acacia</i> <i>pyrifolia</i> and other <i>Acacia</i> spp., and <i>Senna</i> spp. with scattered Eucalypts (mainly <i>Corymbia</i> <i>hamersleyana</i>) and an understorey of mixed tussock and hummock grasses (including some Buffel Grass). The substrate can be sandy in places but generally consists of clay loam with gravel or stone.	The Minor Drainage Line habitat is located throughout the Study Area and represents the small drainage channels within the Hillcrest/ Hillslope habitat type and associated with in and out flows from the Drainage Area/ Floodplain habitat. As such the habitat contains instances of overhangs and rocky outcrops. The Minor Drainage Line habitat is common throughout the Pilbara bioregion particularly within the Chichester and Hamersley subregions where it is associated with the stony substrates. As a drainage-type habitat it is well connected through the landscape.	

Habitat	Distinguishing habitat characteristics	Extent of the habitat	Photo
Gorge/ Gully 8.8 ha 2.2% Significance: High	Gorges and gullies are rugged, steep-sided valleys incised into the surrounding landscape. Gorges tend to be deeply incised, with steep cliff faces, while gullies are more open. Caves, overhangs and short-lived shallow pools are most often encountered in this habitat type. Vegetation is dominated by Callitris trees with other scattered shade/rock-loving trees over a complex mix of shrubs and grasses in areas with greater soil deposition, or sparse and simple where soils are skeletal, and erosion has occurred.	Within the Study Area this habitat type is restricted to the northern portion of the southern polygon at the divide of the range (Figure 4.2). This habitat type is relatively common throughout the Pilbara and represents a habitat that is relatively unique to the region. While the broad habitat is well-represented outside of the Study Area, throughout the region and in conservation estate.	



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Legend

Study area

Cave/ Crevasse

Habitat Type

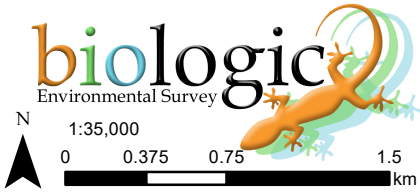
Cleared/ Disturbed

Drainage Area/ Floodplain

Gorge/ Gully

Hillcrest/ Hillslope

Minor Drainage Line



BHP Western Australian Iron Ore

MAC4 Pipeline Fauna Survey

Figure 4.2: Fauna habitats mapped over the Study Area

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A4. Created 19/2/2019

4.3 Fauna Habitat Features

No semi-permanent or permanent water features were recorded within the Study Area during the survey. It is considered likely that temporary water features within the Gorge/Gully, Minor Drainage Line and Drainage Area/ Floodplain habitats may be present in the Study Area after significant rainfall events. However, such temporary features are unlikely to be of high significance as they are relatively common after rainfall, and species of conservation significance are unlikely to be dependent on single instances of these.

One cave was recorded within the Study Area in the northeast portion of the southern polygon within the Gorge/Gully habitat type (Appendix D). This feature is expressed as a crack. The cave was inaccessible due to safety concerns but was highlighted because it may support species of conservation significance, specifically the Ghost Bat. No evidence of the Ghost Bat or Pilbara Leaf-nosed Bat was recorded from or surrounding this feature, however it was deemed as a potential feeding roost as it possessed features similar to that of known feeding sites being relatively deep (~16 m), dark and likely to have a stable microclimate (Armstrong, 2000; Armstrong & Anstee, 2000) (Figure 4.2, Appendix D).

4.4 Potential Significance of Habitats Recorded in the Study Area

One of the habitat types recorded in the Study Area was deemed to be of high value to fauna of conservation significance, the Gorge/ Gully. Two habitats, the Drainage Area/ Floodplain and Minor Drainage Line were deemed to be of moderate value and Hillcrest/ Hillslope are deemed to be of low value (Table 4.4).

The Gorge/Gully was deemed to be of high significance as it potentially provides denning and foraging habitat for the Northern Quoll, Pilbara Olive Python and Northern Brushtail Possum. The habitat type also provides potential foraging habitat for the Ghost Bat and Pilbara Leaf-nosed Bat, and general habitat for Pilbara Flat-headed Blind Snake.

The Drainage Area/ Floodplain habitat was considered to be of moderate significance because is potentially provides dispersal habitat for the Northern Quoll, Ghost Bat, Pilbara Leaf-nosed Bat and Pilbara Olive Python; primary foraging habitat for the Ghost Bat, Pilbara Leaf-nosed Bat, Pilbara Olive Python, Grey Falcon, Peregrine Falcon, as well as general habitat for Pilbara Flat-headed Blind Snake. Minor Drainage Line is considered to be of moderate value as it may possibly provide marginally suitable denning and foraging opportunities for the Northern Quoll and Pilbara Olive Python, as well as general habitat for the and Pilbara Flat-Headed Blind Snake; however, these habitats are not restricted in their distribution and exist widely across the Pilbara.

The Hillcrest/ Hillslope habitat type was considered to be of low significance. The Hillcrest/ Hillslope provides supporting habitat to numerous species, including the Western Pebble-mound Mouse and Pilbara Barking Gecko although the habitat is generally common in the subregion.

Table 4.4: Potential significance of fauna habitat types and justification for significance

Habitat type	Significance	Potential species supported	Justification for significance
Drainage Area/ Floodplain	Moderate	- Northern Quoll (dispersal) - Ghost Bat (foraging and dispersal) - Pilbara Leaf-nosed Bat (foraging and dispersal) - Pilbara Olive Python (foraging, dispersal) - Grey Falcon (foraging) - Peregrine Falcon (foraging) - Pilbara Flat-headed Blind Snake	Has the potential to provide habitat for a number of species of conservation significance listed under the EPBC Act, and in addition provides a range of habitat uses (dispersal, foraging etc) for these species. As a narrow, linear feature, they make up a small proportion of the total land area, although this is not expected to change the likelihood of conservation listed species occurring.
Gorge/ Gully	High	- Northern Quoll (denning, foraging) - Ghost Bat (foraging) - Pilbara Leaf-nosed Bat (foraging) - Pilbara Olive Python (denning, foraging) - Northern Brush-tailed Possum (denning, foraging) - Pilbara Flat-headed Blind Snake	Has the potential to provide habitat for a number of different conservation listed species listed under the EPBC Act, provides denning and roosting habitat, as well as foraging habitat for these species. This habitat is prone to forming important habitat features such as overhangs and caves and water features.
Hillcrest/ Hillslope	Low	- Western Pebble-mound Mouse (recorded) - Pilbara Barking Gecko	Provides potential habitat for some conservation listed species, however the number supported is lower than that of other habitat types present. In addition, these conservation species are not restricted to the habitat type. Hillcrest/hillslope is also a relatively common habitat type throughout the both the Pilbara and the local region.
Minor Drainage	Moderate	- Northern Quoll (denning, foraging) - Northern Brush-tailed Possum (denning, foraging) - Pilbara Olive Python (denning, foraging, dispersal) - Pilbara Flat-headed Blind Snake	Does not solely support conservation listed species at the broad scale, or any conservation species occurring are not restricted to this habitat type. Is represented as an extension of the Gorge/Gully habitat and thus provides similar habitat features to this habitat type, although to a much lesser extent.

4.5 Fauna Recorded

A total of 11 vertebrate fauna species, comprising one mammal species, eight bird species, and two reptile species were recorded from the Study Area during the current survey directly and/or via secondary evidence (Table 4.5). All the species recorded during the current survey have previously been recorded within the surrounding area. One species recorded, is deemed to be of conservation significance, the Western Pebble-mound Mouse (*Pseudomys chapmani*) (Figure 4.3). The Western Pebble-mound Mouse is currently listed as Priority 4 by the DBCA – see Section 4.6.2 for more detail.

Table 4.5: Vertebrate Fauna Recorded During the Current Survey

Scientific Name	Common Name	Current Conservation Status			
		EPBC Act	BC Act	DBCA	IUCN
Mammals					
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse			P4	
Birds					
<i>Colluricincla harmonica</i> subsp. <i>rufiventris</i>	Grey Shrike-thrush				
<i>Gavicalis virescens</i>	Singing Honeyeater				
<i>Malurus lamberti</i> subsp. <i>assimilis</i>	Variegated Fairy-wren				
<i>Pachycephala rufiventris</i> subsp. <i>rufiventris</i>	Rufous Whistler				
<i>Platycercus zonarius</i> subsp. <i>zonarius</i>	Port Lincoln Parrot				
<i>Rhipidura leucophrys</i> subsp. <i>leucophrys</i>	Willie Wagtail				
<i>Smicrornis brevirostris</i>	Weebill				
<i>Taeniopygia guttata</i> subsp. <i>castanotis</i>	Zebra Finch				
Reptiles					
<i>Ctenophorus isolepis</i> subsp. <i>isolepis</i>	Crested Dragon				
<i>Ctenotus inornatus</i>					

4.6 Fauna of Conservation Significance

A total of 29 species of conservation significance have previously been recorded within the vicinity of the Study Area, based on the results of the desktop assessment (refer to Section 4.1). Comprising ten mammals, 16 birds and three reptiles (Table 4.2)

Table 4.6 Conservation significant species likelihood assessment

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Mammals								
Northern Quoll <i>(Dasyurus hallucatus)</i>	EN	EN	The species tends to inhabit rocky habitats which offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths, 1994; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski <i>et al.</i> , 2008).	Yes - Gorge/ Gullies (denning); Minor Drainage Line (foraging), Drainage/ Floodplain (dispersal)	Yes	0.8km W at Camp Hill (Onshore, 2011) 6km S at Southern Flank (Biologic, 2011a) 10km W (Biologic, 2013)	No	Possible
Greater Bilby <i>(Macrotis lagotis)</i>	VU	VU	Variety of habitats including spinifex hummock grassland and Acacia shrubland, on soft soils (Burrows <i>et al.</i> , 2012). In the Pilbara often associated with major drainage line sandy terraces (How <i>et al.</i> , 1991).	Unlikely – marginally suitable habitat in the Drainage/ Floodplain habitat type	No	Two records from 26 km SW at ‘The Governor’ in 1983 and 1984 (DBCA, 2019)	No	Unlikely
Ghost Bat <i>(Macroderma gigas)</i>	VU	VU	Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong & Anstee, 2000). These features often occur within habitats including gorge/gully, hill crest/hill slope and low hills (Armstrong & Anstee, 2000).	Yes – Gorge/ Gully, Drainage Line/ Floodplain (foraging); Potential feeding cave recorded from Gorge/ Gully	Yes	Numerous records within 30 km of the Study Area (DBCA, 2019), including a known cave (ACW-01) less than 1 km to the west (Biologic, 2018)	No	Likely
Pilbara Leaf nosed Bat <i>(Rhinonictis aurantia)</i>	VU	VU	Roosts within caves and abandoned mines with high humidity (95%) and temperature (32 °C) (Armstrong, 2001). This species forages in caves and along waterbodies with fringing vegetation (TSSC, 2016).	Yes – Gorge/ Gully, Drainage Line/ Floodplain (foraging); Potential feeding cave recorded from Gorge/ Gully	Yes	~1 km W at Camp Hill (Onshore, 2011) 10 km SW at Southern Flank (Biologic, 2011a) and 16 km SE at the R-Deposit in 2009 (DBCA, 2019)	No	Possible

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Northern Brushtail Possum (<i>Trichosurus vulpecula arnhemensis</i>)	-	VU	Very restricted distribution in the Pilbara region, with most records from north of the Chichester Range and only a few known from the Hamersley Range (Woinarski <i>et al.</i> , 2014). It is largely known from gorges and major drainage lines with Eucalypt woodland (Biologic, 2011a).	Yes – Gorge/ Gully (denning and foraging)	Marginal – scattered records in the Hamersley Range	~6 km S at West Packsaddle (Astron, 2010a; Astron & Biologic, 2010)	No	Possible
Brush-tailed Mulgara (<i>Dasycercus blythi</i>)	-	P4	Prefers spinifex <i>Triodia</i> spp. grasslands on sand plains and the swales between low dunes (Pavey <i>et al.</i> , 2012; Woolley, 2006). Mature spinifex hummocks appear to be important for protection from introduced predators (Körtner <i>et al.</i> , 2007).	Unlikely – marginally suitable habitat in the Drainage/ Floodplain habitat	Yes	48 km ENE, at boundary of E 47/1385-I and M 47/1439-I (DBCA, 2019)	No	Unlikely
Short-tailed Mouse (<i>Leggadina lakedownensis</i>)	-	P4	The species occupies a diverse range of habitats from the monsoon tropical coast to semiarid climates, including spinifex and tussock grasslands, samphire and sedgelands, <i>Acacia</i> shrublands, tropical eucalypt and <i>Melaleuca</i> woodlands and stony ranges; however, the species is usually found in seasonally inundated habitats on red or white sandy-clay soils (Moro & Kutt, 2008)	Unlikely – no cracking clays within the Study Area	Yes	10 km E within Juna Downs from 1997 (DBCA, 2019) and ~17km W (Biologic, 2013)	No	Unlikely
Western Pebble-mound Mouse (<i>Pseudomys chapmani</i>)	-	P4	This species occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Anstee, 1996; Start <i>et al.</i> , 2000).	Yes – Hillcrest/ Hillslope	Yes	5 km SE along Packsaddle Range in 2004 (DBCA, 2019)	Yes	Confirmed during current survey

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Long-tailed Dunnart (<i>Sminthopsis longicaudata</i>)	-	P4	It is found in rocky areas of central Western Australia and central southern Northern Territory. In Western Australia it is found in the Pilbara, Murchison, North-eastern Goldfields, Ashburton, and Gibson Desert regions (Burbidge <i>et al.</i> , 2008). It is found in rocky scree and plateau areas, generally with little vegetation or of spinifex hummock grassland, shrubs, and open woodland (Burbidge <i>et al.</i> , 2008).	Yes – Gorge/ Gully, Hillslope/ Hillcrest (denning, foraging)	Yes	93 km ESE within ML 244SA (1997) (DBCA, 2019)	No	Unlikely
Chocolate Wattled Bat (<i>Chalinolobus morio</i>)	Locally Significant		The Chocolate Wattled Bat is distributed across southern Australia, with isolated populations occurring in the Hamersley Ranges in Western Australia and central Australia in the Northern Territory (Churchill, 2008). In the Pilbara, this species is only known from the Weeli Wolli-Marillana Creek system (Bullen & McKenzie, 2009). The Chocolate Wattle Bat typically roosts in old tree hollows and disused birds' nests whereby roosts span from 20 to a few hundred bats in size (Johnson, 2008). The species is dependent on riparian vegetation (Bullen & McKenzie, 2011) with complex vegetation structures and permanent pools set in cavernous landscapes.	Unlikely – No Major Drainage Lines	No	18 & 19 km NE Area C West to Yandi (2012) 29 km NNE (2014) (DBCA, 2019)	No	Unlikely

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Birds								
Curlew Sandpiper <i>(Calidris ferruginea)</i>	CR/MI	VU/MI	Inhabits intertidal mudflats in sheltered coastal areas (i.e. estuaries, bays, inlets and lagoons) (Geering <i>et al.</i> , 2007). This rare species generally roosts on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands (Geering <i>et al.</i> , 2007).	Unlikely – No open waterbodies or Major Drainage Lines	Yes	113 km SE (2005) (DBCA, 2019)	No	Unlikely
Night Parrot <i>(Pezoporus occidentalis)</i>	EN	EN	The Night Parrot prefers sandy/stony plain habitat with old-growth spinifex (<i>Triodia</i>) for roosting and nesting in conjunction with native grasses and herbs for foraging (DPaW, 2017).	No – All spinifex recently burnt and is not considered to be old growth	Yes	~75 km NE (2005) north Fortescue River (DBCA, 2019)	No	Highly Unlikely
Australian Painted Snipe <i>(Rostratula benghalensis subsp. australis)</i>	EN	EN	Generally, occupies shallow terrestrial freshwater wetlands (i.e. temporary and permanent lakes, swamps and claypans) with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire (Johnstone & Storr, 1998).	Unlikely – No open waterbodies or Major Drainage Lines	Yes	~82km NE (2012) (DBCA, 2019)	No	Unlikely
Grey Falcon <i>(Falco hypoleucos)</i>	-	VU	Timbered lowlands, particularly Acacia shrubland and along inland drainage systems. Also frequent spinifex and tussock grassland (Burbidge <i>et al.</i> , 2010; Olsen & Olsen, 1986)	Yes - Drainage Area/ Floodplain (foraging)	Yes	11 km south at Area C South Flank Deposit in 2008 (DBCA, 2018)	No	Possible
Common Sandpiper <i>(Actitis hypoleucos)</i>	MI	MI	Estuaries and deltas of streams, as well as banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans (Johnstone & Storr, 1998).	Unlikely – No open waterbodies or Major Drainage Lines	No	~112 km NW (2002) ~101 km SE (2012) (DBCA, 2019)	No	Highly Unlikely

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Fork-tailed Swift (<i>Apus pacificus</i>)	Mi	MI	Inhabits dry/open habitats, inclusive of riparian woodlands and tea-tree swamps, low scrub, heathland or saltmarsh, as well as treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (Johnstone & Storr, 1998).	Yes – All habitat types	Yes	20 km E (Biologic, 2011a) 31 km S at the West Angelas mine site in 2013 (DBCA, 2018)	No	Rarely
Grey Wagtail (<i>Motacilla cinerea</i>)	MI	MI	A rare vagrant to Western Australia where it has been recorded within various habitats with open waterbodies (Johnstone & Storr, 2004).	Unlikely – No open waterbodies or Major Drainage Lines	No	~72km NNE (2012) (DBCA, 2019)	No	Highly Unlikely
Yellow Wagtail (<i>Motacilla flava</i>)	MI	MI	An uncommon but regular visitor to the Pilbara region (Johnstone <i>et al.</i> , 2013). Occupies a range of damp or wet habitats with low vegetation although favours edges of fresh water, especially sewage ponds (Oakwood, 2000)	Unlikely – No open waterbodies or Major Drainage Lines	No	~288km NNW (1982) (DBCA, 2019)	No	Highly Unlikely
Oriental Plover (<i>Charadrius veredus</i>)	MI	MI	A variety of habitats, including coastal habitats, such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches as well as open inland environments such as, semi-arid or arid grasslands, where the grass is short and sparse (Johnstone & Storr, 2004).	Unlikely – No open waterbodies or Major Drainage Lines	No	101km NW (2017) (DBCA, 2019)	No	Highly Unlikely
Pectoral Sandpiper (<i>Calidris melanotos</i>)	MI	MI	Coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (Johnstone & Storr, 2004; Johnstone <i>et al.</i> , 2013). It prefers wetlands with open fringing mudflats and low, emergent or fringing vegetation (Geering <i>et al.</i> , 2007).	Unlikely – No open waterbodies or Major Drainage Lines	No	~104km SE (1981) (DBCA, 2019)	No	Highly Unlikely

Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Barn Swallow (<i>Hirundo rustica</i>)	MG	MI	The Barn Swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Found near freshwater wetlands, paperbark <i>Melaleuca</i> woodland, mesophyll shrub thickets and tussock grassland (Schodde & Mason, 1999). The Barn Swallow is a non-breeding summer visitor to the Pilbara. It favours areas near water (Johnstone & Storr, 2004).	Unlikely – No open waterbodies or Major Drainage Lines	No	Coastal records near Port Headland, 272 km NW (2001), (2005), (2014,2015) (DBCA, 2019)	No	Highly Unlikely
Sharp-tailed Sandpiper (<i>Calidris acuminata</i>)	Mi	MI	Favours flooded samphire flats and grasslands, mangrove creeks mudflats, beaches, river pools, saltwork ponds, sewage ponds and freshwater soaks (Johnstone <i>et al.</i> , 2013).	Unlikely – No open waterbodies or Major Drainage Lines	No	105 km SE (1981), 103km NE (2003), 116km NE (2001) (DBCA, 2019)	No	Highly Unlikely
Wood Sandpiper (<i>Tringa glareola</i>)	Mi	MI	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in river pools, sewage ponds, flooded claypans, freshwater lagoons and bore overflows (Johnstone <i>et al.</i> , 2013).	Unlikely – No open waterbodies or Major Drainage Lines	No	~4 km S (2013) (Biologic, 2013)	No	Highly Unlikely
Peregrine Falcon (<i>Falco peregrinus</i>)	-	OS	In arid areas, it is most often encountered along cliffs above rivers, ranges and wooded watercourses where it hunts birds (Johnstone & Storr, 1998). It typically nests on rocky ledges occurring on tall, vertical cliff faces between 25 m and 50 m high (Olsen <i>et al.</i> , 2004; Olsen & Olsen, 1989).	Yes - Drainage Area/ Floodplain (foraging)	Yes	~6 km NW and 10km W (Biologic, 2013). Also recorded 8 km S at Southern Flank (Biologic, 2011a)	No	Likely
Eastern Osprey (<i>Pandion haliaetus</i>)	MG	MI	Occurs mainly in sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, also large river pools (Johnstone <i>et al.</i> , 2013).	Unlikely – No open waterbodies or Major Drainage Lines	No	54 km NE (2011), 59km NNE (2012) (DBCA, 2019)	No	Unlikely

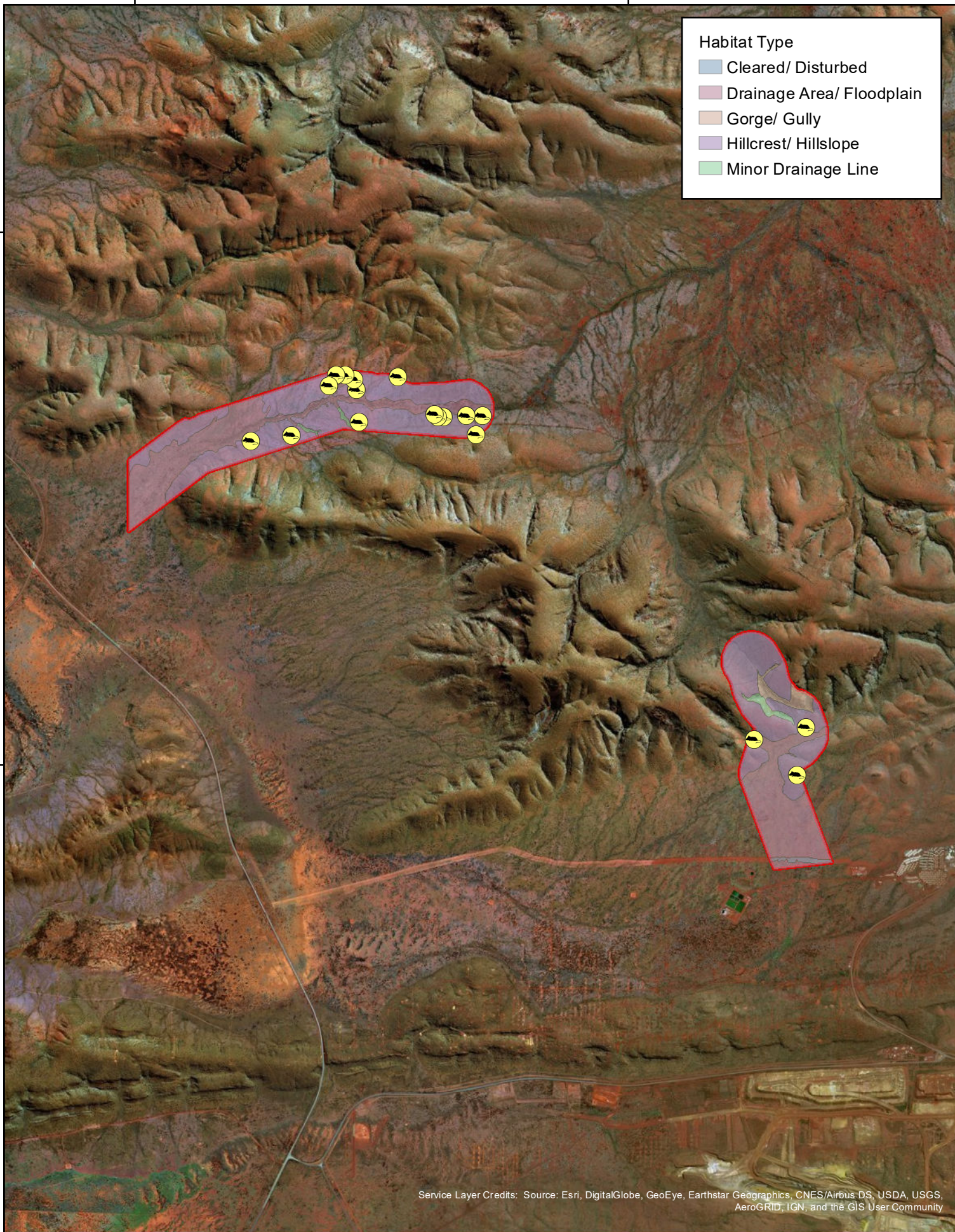
Species	Conservation Status		Preferred Broad Habitats Within Region	Potential Habitat Within Study Area	Within Current Known Distribution	Distance to Nearest Record - Year	Recorded Within Study Area	Likelihood of Occurrence
	EPBC Act	BC Act						
Common Greenshank (<i>Tringa nebularia</i>)	MG	MI	Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in Tidal mudflats, mangrove creeks, flooded samphire flats, beaches, river pools, and saltwork and sewage ponds (Johnstone <i>et al.</i> , 2013).	Unlikely – No open waterbodies or Major Drainage Lines	No	Two records 21 km NE at Yandi in 2011 (DBCA, 2018)	No	Unlikely
Reptiles								
Pilbara Olive Python (<i>Liasis olivaceus</i> subsp. <i>barroni</i>)	VU	VU	Associated with drainage systems, including areas with localised drainage and watercourses (Pearson, 1993). In the inland Pilbara the species is most often encountered near permanent waterholes in rocky ranges or among riverine vegetation (Pearson, 1993).	Yes - Gorges/ Gully (denning, foraging); Drainage/ Floodplain, Minor Drainage Line (foraging, dispersal)	Yes	9 km SW (Biologic, 2013) 16 km E at Area C Mine in 2008 (DBCA, 2018)	No	Possible
Pilbara Flat-headed Blind-snake (<i>Anilius ganei</i>)	-	P1	Little is known of the species' ecology but this species is often associated with moist soils and leaf litter within gorges and gullies (Wilson & Swan, 2014), and potentially within a wide range of other stony habitats. The species has been recorded from numerous habitats but is most likely to be present in rocky terrain and along drainage lines (DBCA, 2018), such as that found in the Study Area.	Yes - Gorge/ Gully, Drainage/ Floodplain	Yes	~18 km E (Biologic, 2011a) 19 km SE at the R-Deposit project in 2006 (DBCA, 2019)	No	Possible
Pilbara Barking Gecko (<i>Underwoodisaurus seorsus</i>)		P2	Little is known about the ecology of the Pilbara Barking Gecko. Suitable habitat for this species would be gorge and gully, hillslope, cliff and ridge.	Yes – Hillcrest/ Hillslope	Yes	Four records from 5 km E in 2004 at Packsaddle Range (DBCA, 2018)	No	Likely

118.8° E

118.85° E

Habitat Type

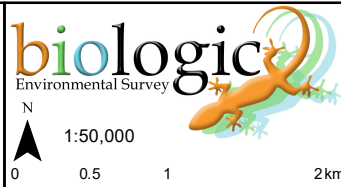
- Cleared/ Disturbed
- Drainage Area/ Floodplain
- Gorge/ Gully
- Hillcrest/ Hillslope
- Minor Drainage Line



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Legend

- Study area
- Pseudomys chapmani* (western pebble-mound mouse) (P4)



BHP Western Australian Iron Ore
MAC4 Pipeline Fauna Survey
Figure 4.3: Species of conservation significance occurring within the Study Area

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A4. Created 23/1/2019

4.6.1 EPBC Matters

The sections below provide summaries on the Program Matters identified in the approved Program for BHP's Strategic Assessment (Greater Bilby, Northern Quoll, Pilbara Leaf-nosed Bat, Ghost Bat and Pilbara Olive Python) as well as the Night Parrot.

Northern Quoll (*Dasyurus hallucatus*)

The Northern Quoll is listed as Endangered under the EPBC Act and Endangered under the BC Act. The species was once widely distributed across northern Australia, although is now restricted to three isolated populations; the Pilbara, the Kimberley and Northern Territory, and Queensland, in addition to a number of islands along the north coast (DoE, 2016).

The Northern Quoll is both arboreal and terrestrial, inhabiting ironstone and sandstone ridges, scree slopes, granite boulders and outcrops, drainage lines, riverine habitats (Braithwaite & Griffiths, 1994; Oakwood, 2002), dissected rocky escarpments, open forest of lowland savannah and woodland (Oakwood 2002, 2008). Rocky habitats tend to support higher densities, as they offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths, 1994; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al.*, 2008). Dens occur in a wide range of situations including rock overhangs, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings/infrastructure, where individuals usually den alone (Oakwood, 2002; Woinarski *et al.*, 2008). At present Northern Quolls are relatively common in the northern Pilbara region (generally within 150 km of the coast) but are much less common in southern and south-eastern parts of the region (Cramer *et al.*, 2016).

The species tends to inhabit rocky habitats which offer protection from predators and are generally more productive in terms of availability of resources (Braithwaite & Griffiths, 1994; DoE, 2016; Oakwood, 2000). Other microhabitat features important to the species include: rock cover; proximity to permanent water and time-since last fire (Woinarski *et al.*, 2008). The nearest confirmed record of the species was of an old scat located 0.8 km west at Camp Hill (Onshore, 2011). The next nearest records have been recorded 6 km south, at Southern Flank (Biologic, 2011a), and 10 km west (Biologic, 2013), both of which were records of old scats. While these represent nearby contemporary records, an extensive amount of work has been undertaken in the vicinity of the Study Area, suggesting that the species occurs intermittently in the Study Area rather than as a permanent resident. Potential habitat does occur within the Study Area, in the form of Gorge/ Gully (potential denning and foraging habitat) and Minor Drainage Line (foraging) and to a lesser extent Hillslope/ Hillcrest (secondary foraging) – each of which represents core habitat as defined by DoE (2016). Due to the presence of the species' preferred habitat and scattered nearby records, it is considered possible that this species could occur within the Study Area.

Greater Bilby (*Macrotis lagotis*)

Extant population of the Greater Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils (Southgate, 1990). It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises,

and hummock grassland in plains and alluvial areas (Southgate, 1990). Within the Pilbara region the species is recorded within spinifex sandplains (Dziminski & Carpenter, 2016). The nearest records (2) of this species is located approximately 26 km South West at 'The Governor' in 1983 and 1984 (DBCA, 2018).

Some minor sandy spinifex areas exist in the Study Area within the Drainage Area/ Floodplain. However, in the Study Area this habitat type was noted as containing a high amount of alluvial material making it less suitable for burrowing compared to deep Sand Plains – for that reason it is unlikely to be suitable habitat for the species. Based on the presence of the unsuitable habitat and the lack of nearby recent records, the species was assessed as being Unlikely to occur in the Study Area.

Ghost Bat (*Macroderma gigas*)

Ghost Bats roost in deep, complex caves beneath bluffs of low, rounded hills, granite rock piles and abandoned mines (Armstrong & Anstee, 2000). These features often occur within habitat types including gorge/gully, hill crest/hill slope and low hills (Armstrong & Anstee, 2000).

Ghost Bats are known to require a number of suitable caves throughout their home ranges; both due to temporal factors (i.e. night/ feeding roosts for feeding throughout the duration of the night, as well as day roosts for resting), and seasonal factors (use of certain caves as maternity roosts, depending on the right environmental conditions). The presence of day roosts and/ or maternity roosts in an area is the most important indicator of suitable habitat for Ghost Bats, and these caves are generally the primary focus of conservation and/or monitoring (DoE, 2015).

Numerous records of the species are located within 30 km of the Study Area (DBCA, 2018), including a known diurnal roost (ACW01) and three records ~1 km to the west from 2012 (Biologic, 2017). There is another record from ~2.9 km south-east of the southern polygon also from 2012. There is a cave that was recorded within the Study Area (CMAC01), but was unable to be assessed, therefore was classed as a potential feeding roost. Potential primary foraging habitat exists in the Drainage Area/ Floodplain and the Gorge/ Gully habitats of the Study Area.

Pilbara Leaf-nosed Bat (*Rhinonictis aurantia*) Pilbara Form

The Pilbara Leaf-nosed Bat is classified as Vulnerable under the EPBC Act and the BC Act. The species is restricted to the Pilbara region and is thought to have been separated from populations of the Orange Leaf-nosed Bat in the Kimberley, northern Territory and western Queensland for at least 30,000 years (Van Dyck & Strahan, 2008). This species limited ability to conserve heat and water (Armstrong, 2001) means it requires warm (28-32°C) and very humid (85 – 100%) roost sites in caves (Armstrong, 2001; Churchill, 1991) and/or mine shafts as these enable the individuals to persist in arid climates by limiting water loss and energy expenditure (Van Dyck & Strahan, 2008). Such caves are relatively uncommon in the Pilbara (Armstrong and Anstee 2000; Armstrong 2001), which limits the availability of diurnal roosts for this species. Until recently, only two roosts of the species were known, both in disused mineshafts; however, the number of roost sites is increasing as biological surveys becoming geographically more widespread (Armstrong, 2001). Population subdivision may occur between western and eastern groups of the Pilbara Leaf-nosed Bat; however, the extent of genetic separation is not known (Armstrong, 2001).

The Pilbara population is regarded as representing a single interbreeding biological population comprising multiple colonies (TSSC, 2016).

Pilbara Leaf-nosed Bats roost in undisturbed caves, deep fissures or abandoned mine shafts. During the dry season, approximately March to August, Pilbara Leaf-nosed Bats aggregate in colonies within caves that provide a suitably warm, humid microclimate; however, the species disperses from these main colonies during the wet season, approximately September to February, when suitably humid caves are more widely available (TSSC, 2016). The level of dispersal in the wet season may also be influenced by the seasonal availability of food resources (Churchill, 1994).

The nearest confirmed records of the species are located approximately 1 km west of the Study Area at Camp Hill (Onshore, 2011). There are also two more records, 10 km south at Southern Flank (Biologic, 2011a) and 16 km south-east at the R-Deposit in 2009 (DBCA, 2018). While these represent nearby contemporary records, an extensive amount of work has been undertaken in the vicinity of the Study Area, suggesting that the species occurs intermittently in the Study Area rather than as a permanent resident. Further to this, no roosts of the species are known to occur within the nightly range (20 km; Bullen, 2013) of the species (TSSC, 2016).

No suitable diurnal roosting features were recorded within the Study Area. Suitable foraging habitat for the species is present in the Study Area, in the form of the Drainage Area/ Floodplain and Gorge/ Gully habitat. However, because the species is not known to regularly occur in the area, these may only be used on an irregular basis.

Pilbara Olive Python (*Liasis olivaceus barroni*)

This species is often associated with drainage systems, including areas with localised drainage and watercourses (Pearson, 1993). In the inland Pilbara the species is most often encountered near permanent waterholes in rocky ranges or among riverine vegetation (Pearson, 1993). The nearest records are 9 km south-west (Biologic, 2013) and 16 km east at Area C Mine in 2008 (DBCA, 2018). The Gorge/ Gully habitat provides suitable denning and foraging habitat for the species. Suitable dispersal habitat is present in the form of the Drainage Area/ Floodplain and Minor Drainage Line habitat. As such it is possible that the species may occur within the Study Area.

Night Parrot (*Pezoporus occidentalis*)

The Night Parrot is listed as Endangered under the EPBC Act, by the IUCN and Critically Endangered under the BC Act. The night parrot was thought to be extinct but in 2013 it was rediscovered in Queensland (Pullen Pullen Reserve). Subsequently, the species has been found in Goneaway National Park and Diamantina National Park in Queensland (Palaszczuk & Miles, 2017) and near Broome in Western Australia (Jones, 2017).

The Night Parrot is a small, elusive and ground dwelling parrot endemic to Australia (DoEE, 2018). This highly cryptic and nocturnal parrot inhabits arid and semi-arid areas that comprise dense, low vegetation. Based on accepted records, the habitat of the Night Parrot consists of *Triodia* grasslands in stony or sandy environments (McGilp, 1931; North, 1898; Whitlock, 1924; Wilson, 1937), and of samphire and

chenopod shrublands, including genera such as *Atriplex*, *Bassia* and *Maireana*, on floodplains and claypans, and on the margins of saltlakes, creeks or other sources of water (McGilp, 1931); (Parker, 1980); (Wilson, 1937)). The Night Parrot was also recorded, on one occasion, in *Acacia* woodland (North, 1898), and a carcass found near Boulia in Queensland was recovered from the side of a road in an area comprised of low, sparse *Astrebla*, *Calotis* and species of chenopods, and with some patches of exposed gibber (Boles et al. 1994). The current interim guidelines for preliminary surveys of Night Parrot suggest this species requires old-growth (often more than 50 years unburnt) spinifex (*Triodia*) for roosting and nesting and habitats that comprise various grasses and herbs for foraging, although little is known about foraging sites. Foraging habitat is not necessarily within or adjacent to roosting habitat as the Night Parrot has been known to fly up to 40km in a single night to forage. *Triodia* is likely to provide a good food resource at least in times of mass flowering and seeding. The succulent *Sclerolaena* has been shown to be a source of food and moisture; other succulent chenopods are also likely to be important. Foraging habitat is likely to be more important if it is adjacent to or within about 10 km of patches of *Triodia* deemed suitable as roosting habitat (DPaW, 2017).

Based on accepted records, the habitat of the Night Parrot consists of *Triodia* grasslands in stony or sandy environments (McGilp, 1931; North, 1898; Whitlock, 1924; Wilson, 1937), and of samphire and chenopod shrublands, including genera such as *Atriplex*, *Bassia* and *Maireana*, on floodplains and claypans, and on the margins of salt lakes, creeks or other sources of water (McGilp, 1931; Wilson, 1937).

The Night Parrot is known from a few historical records within the Pilbara, the nearest contemporary record within the Pilbara region from April 2005 was located at Minga Well approximately 75 km north-East of the Study Area, on the northern side of the Fortescue (Davis & Metcalf, 2008). The Drainage Area/ Floodplain habitat type within the Study Area possesses *Triodia* sp. hummock grassland which is normally considered suitable for roosting, although the spinifex at this site has recently been burnt. Therefore, this habitat is not generally regarded as providing high quality habitat for the species and is not located within the nightly range of suitable foraging habitat. For these reasons and the lack of recent records in the region, it is deemed Highly Unlikely that this species would occur within the Study Area.

4.6.2 Species Confirmed within Study Area

Western Pebble-mound Mouse (*Pseudomys chapmani*)

This species is listed as Priority 4 under the BC act. The Western Pebble-mound Mouse has experienced a significant decline in their range through the Gascoyne and Murchison and is now considered endemic to the Pilbara (Start *et al.*, 2000). This species almost exclusively occurs on the gentler slopes of rocky ranges where the ground is covered with a stony mantle and vegetated by hard spinifex, often with a sparse overstorey of eucalypts and scattered shrubs (Anstee & Armstrong, 2001). The Western Pebble-mound Mouse was confirmed within the study area during this survey. It was recorded via observations at 18 mounds across the survey area. Twelve mounds were considered active, three recently inactive and three inactive. Previously the nearest record to the Study Area was 5 km south-east along Packsaddle Range in 2004 (DBCA, 2018). The Study Area contains Hillcrest/ Hillslope habitats which support the species.

4.6.3 Likely to Occur

Pilbara Flat-headed Blind-snake (*Anilius ganei*)

Given the Pilbara Flat-headed Blindsnake has a cryptic fossorial habit, this species is rarely encountered. Little is known of this species' ecology but like most other blind snakes, it is insectivorous, feeding on termites and their eggs, and larvae and pupae of ants (Cogger, 2014). The Pilbara Flat-headed Blind-snake is associated with moist gorges and gullies (Cogger, 2014), and potentially with a wide range of other stony habitats.

This species was recorded ~18 km east (Biologic, 2011a) and 19 km south-east from the Study Area at the R-Deposit project in 2006 (DBCA, 2018). This species could occur in the Gorge/ Gully and Drainage Area/ Floodplain habitats within the Study Area.

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed under the BC Act as OS "other specially protected fauna" and is considered rare over much of its range (Johnstone & Storr, 1998). In arid areas, it is most often encountered along cliffs above rivers, ranges and wooded watercourses where it hunts birds (Johnstone & Storr, 1998). It typically nests on rocky ledges occurring on tall, vertical cliff faces between 25 m and 50 m high (Olsen & Olsen, 1989). It also appears to prefer nesting on large ledges a reasonable distance (average of 13 m) from the top of the cliff (Olsen & Olsen, 1989), possibly to avoid ground dwelling predators.

The Peregrine Falcon was recorded ~6 km north-west, 10 km west (Biologic, 2013) and 8 km south at Southern Flank (Biologic, 2011a). No large cliffs suitable for nesting of the species were observed in the Study Area and thus unlikely that the species would use any part of the Study Area for breeding. The Gorge/ Gully and Drainage Area/ Floodplain habitat within the Study Area are likely to provide suitable foraging habitat for the species.

Pilbara Barking Gecko (*Underwoodisaurus seorsus*)

The Pilbara Barking Gecko is believed to be rare, it is listed as DBCA P2 and has a relatively small distribution for a vertebrate (Doughty & Oliver, 2011). Little is known about the ecology of the Pilbara Barking Gecko.

Four records of this species exist within 5 km of the Study Area, from Packsaddle Range in 2004. Suitable habitat for this species exists within the Study Area and would be found within Gorge/Gully, Hillcrest/ Hillslope and Minor Drainage Line habitats.

4.6.4 May Possibly Occur

Grey Falcon (*Falco hypoleucos*)

The Grey Falcon is currently listed as Vulnerable under the BC Act. This species appears to have a distribution centred on ephemeral or permanent creek lines (Garnett & Crowley, 2000), with numerous records from the Fortescue Marsh region (DBCA, 2019). Grey Falcons typically forage upon sparsely-

treed, open plains and creek lines (Olsen & Olsen, 1986). They typically nest in the abandoned nest of a raptor or corvid (Olsen & Olsen, 1986) in trees or man-made structures, most notably repeater towers.

The nearest record was 11 km south of the Study Area, located at the Area C South Flank Deposit in 2008 (DBCA, 2019). The Drainage Area/ Floodplain habitat within the Study Area provides potential foraging habitat for the species. The remaining habitats may be flown over, and opportunistically used for foraging, if individuals are resident within the local area. This species is considered possible to occur within the Study Area.

Northern Brush-tail Possum (*Trichosurus vulpecula arnhemensis*)

The Northern Brushtail Possum is not listed under the EPBC Act but is listed as Vulnerable under the BC Act. The species has a very restricted distribution in the Pilbara region, with most records from north of the Chichester Range and only a few known from the Hamersley Range. There is limited information specific to this species in the region. It is also regarded as a 'critical weight range' mammal, and thus regarded as being more susceptible to pressure from introduced predators (Burbidge & McKenzie, 1989). It is largely known from gorges and major drainage lines with Eucalypt woodland (DBCA, 2019).

Several interacting ecological factors, primarily inappropriate fire regime, feral predation by cats and foxes, and habitat loss and fragmentation, are currently causing rapid and severe declines in the small and medium-sized mammal fauna of northern Australia (Woinarski *et al.*, 2015). Within Western Australia, the former range of the Brushtail Possum has been considerably reduced by clearing of habitat and fox predation, including in large areas of arid country. Predation by foxes, cats, dingos, large pythons and large monitors is particularly significant in areas where population numbers are low (DEC, 2012).

There are generally few records of the species within the Pilbara region, particularly within the Hamersley subregion (DBCA, 2019). Of those records, most come from gorges and major drainage lines dominated by eucalypts (DBCA, 2019). The nearest record to the Study Area is ~6 km S at West Packsaddle (Astron, 2010a; Astron & Biologic, 2010). Within the Study Area the Gorge/ Gully, and to a lesser extent the Minor Drainage Line, provide potential habitat for the species, as such the species is deemed possible to occur.

4.6.5 May Rarely Occur

Fork-tailed Swift (*Apus pacificus*)

The Fork-tailed Swift is listed as a Migratory listed species under the BC Act and Migratory protected under the EPBC Act. It is a migratory species that breeds in northeast and east Asia, wintering in Australia and southern New Guinea (Johnstone & Storr, 1998). It is a rare visitor and a largely aerial species not common to any particular terrestrial habitat. The nearest records were located ~20 km East (Biologic, 2011a) and 31 km south at the West Angelas mine site in 2013 (DBCA, 2018). All habitat types within the Study Area provide suitable habitat for the species although individuals would not be restricted to or dependent on these.

5 CONCLUSION

A total of four broad fauna habitat types were recorded and mapped across the Study Area. This comprised, in decreasing order of extent, Hillcrest/ Hillslope, Drainage Area/ Floodplain, Gorge/ Gully and Minor Drainage. One of these habitats, Gorge/ Gully was considered to be of high significance due to the potential to provide habitat for species of conservation significance. Specifically, the Gorge/ Gully provides potential denning and foraging habitat for the Northern Quoll, Pilbara Olive Python, Peregrine Falcon and Northern Brushtail Possum, potential foraging habitat for the Ghost Bat and Pilbara Leaf-nosed Bat, and general habitat for the Pilbara Barking Gecko.

Two habitat types, the Minor Drainage Line and Drainage Area/ Floodplain were considered to be of moderate significance. The Minor Drainage provides potential limited denning and foraging habitat for the Northern Quoll, Northern Brush-tailed Possum, Pilbara Olive Python and the Pilbara Flat-headed Python. The Drainage/Floodplain habitat provides potential foraging and dispersal habitat for the Northern Quoll, Pilbara Olive Python, and potential foraging habitat for the Ghost Bat, Pilbara Leaf-nosed Bat, Peregrine Falcon, Grey Falcon as well as general habitat for the Pilbara Flat-headed Blind Snake. The Hillcrest/ Hillslope habitat was considered to be of low significance, providing potential dispersal and foraging habitat for the Western Pebble-mound Mouse and Pilbara Barking Gecko.

One vertebrate species of conservation significance was recorded during the survey, Western Pebble-mound Mouse listed by the DBCA as Priority 4. The species was confirmed by the presence of 18 mounds, (twelve active, three recently inactive and three inactive). Each was recorded within the Hillcrest/ Hillslope habitat, which is likely to be the main supporting habitat in the Study Area for the species.

Of the 29 conservation significant species identified during the desktop assessment, one species was confirmed as occurring in the Study Area; Western Pebble Mound-mouse. Based on distribution, previous records and the habitats present, it is considered likely that the Ghost Bat, Pilbara Barking Gecko and the Peregrine Falcon are likely to occur within the Study Area. A further six species, the Northern Quoll, Pilbara Leaf-nosed Bat, Grey Falcon, Northern Brushtail Possum, Flat-headed Blind Snake and the Pilbara Olive Python are considered possible to occur within the Study Area. One species, the Fork-tailed Swift, was deemed as rarely occurring across the Study Area. The remaining 18 were considered unlikely or highly unlikely to occur.

One cave was recorded within the Study Area in the northeast portion of the southern polygon within the Gorge/Gully habitat. This feature is expressed as a crack which was inaccessible during this survey. Such a feature was highlighted because it may support species of conservation significance such as the Ghost Bat. No evidence of the Ghost Bat or Pilbara Leaf-nosed Bat was recorded from or surrounding this feature, however it was deemed as a potential feeding roost as it possessed features similar to that of known feeding sites being deep, dark and likely to have a stable microclimate. Without access to the cave, it was estimated at 16 m deep.

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7 APPENDICES

Appendix A: Conservation listings

International Union for Conservation of Nature

Category	Definition
Extinct (Ex)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (Ex)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (Cr)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (En)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (Vu)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Extinct (Ex)	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (EW)	Taxa known to survive only in captivity.
Critically Endangered (Cr)	Taxa facing an extremely high-risk of extinction in the wild in the immediate future.
Endangered (En)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (Vu)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Migratory (Mi)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA); China-Australia Migratory Bird Agreement (CAMBA); Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

Biodiversity Conservation Act 2016

Category	Definition
CR	Rare or likely to become extinct, as <i>critically endangered</i> fauna.
EN	Rare or likely to become extinct, as <i>endangered</i> fauna.
VU	Rare or likely to become extinct, as <i>vulnerable</i> fauna.
EX	Being fauna that is presumed to be extinct.
MI	Birds that are subject to international agreements relating to the protection of migratory birds.
CD	Special conservation need being species dependent on ongoing conservation intervention. (Conservation Dependant)
OS	In need of special protection, otherwise than for the reasons pertaining to Schedule 1 through to Schedule 6 Fauna. (Other specially protected species)

Department of Biodiversity, Conservation and Attractions Priority Definitions

Category	Definition
Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4 (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.

Appendix B: Vertebrate Fauna Identified in the Desktop Assessment

Surveys

- A. Mining Area C Biological Survey (Ecologia, 1998a)
- B. Area C Mining Operation Environmental Management Plan (Revision 4) A, D, P1 and P3 Deposits: Bat Survey and Assessment (Specialised Zoological, 2008)
- C. Area C and Surrounds Vertebrate Fauna Survey (Biologic, 2011a)
- D. Area C West Vertebrate Fauna Survey (Biologic, 2013)
- E. Packsaddle West Vegetation and Flora Survey and Fauna Assessment (Astron, 2010b)
- F. Pilbara Region Ghost Bat Population and Roost Assessment: 2016 - 2017 (Biologic, *in prep.*)
- G. Area C Packsaddle Range Biological Survey (Ecologia, 2004b)
- H. Area A and Additional Areas Level 2 Terrestrial Fauna Survey (Ecologia, 2008)
- I. Area C Deposits D, E and F Biological Survey (Ecologia, 2004a)
- J. Mining Area C Expansion Deposit E Bat Assessment (Ecologia, 2005b)
- K. Southern Flank Vertebrate Fauna Study (Biologic, 2011d)
- L. South Flank Targeted (Biologic, 2016)
- M. Area C South Flank Deposit Fauna Assessment (ENV, 2008a)
- N. Area C Deposit A, D, P1 and P3 Vertebrate Fauna Survey (Outback Ecology, 2008)
- O. Area C Deposit R Fauna Assessment (ENV, 2007)
- P. Area C West Fauna Assessment (ENV, 2008b)
- Q. Newman to Yandi Transmission Line Terrestrial Vertebrate Fauna Assessment (ENV, 2009)
- R. Mudlark Well Exploration Project Biological Survey (Ecologia, 2005a)
- S. Area C to Jinayri to Mount Newman Railway (Outback Ecology, 2010)
- T. Ministers North Biological Survey (Ecologia, 2006)
- U. Weeli Wolli Creek Biological Assessment Survey (Ecologia, 1998b)
- V. Jinidi to Mainline Vertebrate Fauna Survey (Biologic, 2011b)
- W. Jinayri Vertebrate Fauna Assessment (ENV, 2008c)
- X. Jinidi Vertebrate Fauna Survey (Biologic, 2011c)



Mammals

Species		Conservation status				Online DB's				Overlapping				< 10 km										> 10 km										
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	
BOVIDAE																																		
*Bos taurus		European Cattle						•					•		•	•	•			•				•	•				•		•	•	•	•
CANIDAE																																		
*Canis familiaris		Dog						•					•		•	•	•			•			•	•		•	•			•	•	•	•	
*Vulpes vulpes		Red Fox																					•											
CAMELIDAE																																		
*Camelus dromedarius		Dromedary, Camel						•																				•			•	•		
DASYURIDAE																																		
Dasyercus blythi		Brush-tailed Mulgara				P4																									•			
Dasykaluta rosamondae		Little Red Kaluta						•			•	•				•	•						•	•	•			•		•	•	•		
Dasyurus hallucatus		Northern Quoll		EN	EN		EN	•	•	•		•																						
Ningauí timealeyi		Pilbara Ningauí						•			•	•				•	•					•					•		•	•	•			
Planigale ingrami		Long-tailed Planigale						•				•																						
Planigale sp. 1		Undescribed Pilbara planigale									•	•	•			•	•							•	•		•		•	•				
Pseudantechinus roryi		Rory's Pseudantechinus						•																										
Pseudantechinus woolleyae		Woolley's Pseudantechinus						•				•	•	•						•														
Sminthopsis crassicaudata		Fat-tailed Dunnart																									•							
Sminthopsis dolichura		Little long-tailed Dunnart						•																										
Sminthopsis longicaudata		Long-tailed Dunnart				P4																												
Sminthopsis macroura		Stripe-faced Dunnart						•			•	•					•	•						•			•			•				
Sminthopsis ooldea		Ooldea Dunnart						•			•																							
Sminthopsis youngsoni		Lesser Hairy-footed Dunnart						•			•														•						•	•		
EMBALLONURIDAE																																		
Saccolaimus flaviventris		Yellow-bellied Sheathtail-bat						•					•	•	•			•	•	•			•				•	•		•	•	•		
Taphozous georgianus		Common Sheathtail-bat						•				•	•	•	•	•		•	•	•	•		•		•	•	•		•	•	•	•		
Taphozous hilli		Hill's Sheathtail-bat						•			•														•						•			
EQUIDAE																																		
*Equus asinus		Donkey						•																			•							
*Equus caballus		Horse						•					•			•																		
FELIDAE																																		
*Felis catus		Cat						•				•					•		•			•	•			•	•			•	•			
HIPPOSIDERIDAE																																		
Rhinonictes aurantia		Pilbara Leaf-nosed Bat		VU	VU	P4		•	•	•														•								•		
LEPORIDAE																																		
*Oryctolagus cuniculus		Rabbit						•																	•		•		•					
MACROPODIDAE																																		
Osphranter robustus subsp. erubescens		Euro, Biggada						•			•	•	•	•		•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	
Osphranter rufus		Red Kangaroo, Marlu						•				•				•							•	•		•				•	•	•		
Petrogale rothschildi		Rothschild's Rock-wallaby						•			•	•	•	•					•							•				•			•	
MEGADERMATIDAE																																		



Species		Conservation status				Online DB's				Overlapping				< 10 km										> 10 km															
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X						
Macroderma gigas	Ghost Bat	VU	VU		VU		•	•				•	•	•	•												•			•	•	•							
MOLOSSIDAE																																							
Chaerephon jobensis subsp. colonicus	Greater Northern Freetail-bat					•						•	•				•					•		•	•		•	•	•		•	•	•						
Ozimops lumsdenae	Northern Free-tailed Bat					•				•	•	•	•			•	•	•				•		•	•			•	•	•	•	•	•						
Austronomus australis	White-striped Freetail-bat											•				•	•					•					•		•	•	•								
MURIDAE																																							
Leggadina lakedownensis	Short-tailed Mouse			P4		•		•					•																										
*Mus musculus	House Mouse					•						•	•							•				•					•		•								
Notomys alexis	Spinifex Hopping-mouse					•																					•			•	•								
Pseudomys chapmani	Western Pebble-mound Mouse			P4		•		•	•	•		•	•			•	•	•				•	•	•		•	•	•	•	•	•	•	•						
Pseudomys delicatulus	Delicate Mouse					•																																	
Pseudomys desertor	Desert Mouse					•						•	•				•							•	•					•									
Pseudomys hermannsburgensis	Sandy Inland Mouse					•			•	•		•	•				•	•					•		•		•		•	•	•								
Pseudomys nanus	Western Chestnut Mouse					•																																	
Zyzomys argurus	Common Rock-rat					•			•	•		•	•	•			•	•		•		•	•	•	•		•			•	•								
PHALANGERIDAE																																							
Trichosurus vulpecula subsp. arnhemensis	Northern Brushtail Possum		VU											•																									
TACHYGLOSSIDAE																																							
Tachyglossus aculeatus	Echidna									•		•	•							•										•			•						
THYLACOMYIDAE																																							
Macrotis lagotis	Bilby, Dalgyte	VU	VU		VU	•	•	•																															
VESPERTILIONIDAE																																							
Chalinolobus gouldii	Gould's Wattled Bat					•				•	•	•	•			•	•	•				•		•	•		•	•	•		•	•	•						
Chalinolobus morio	Chocolate Wattled Bat	Locally Significant				•																						•	•										
Nyctophilus daedalus	Northwestern Long-eared Bat					•											•									•		•		•									
Nyctophilus geoffroyi	Lesser Long-eared Bat					•						•	•			•								•	•		•	•	•	•	•	•	•						
Scotorepens greyii	Little Broad-nosed Bat					•			•	•	•	•	•			•	•	•				•		•	•	•	•	•		•	•	•	•						
Vespadelus finlaysoni	Finlayson's Cave Bat					•			•	•	•	•	•	•		•	•	•	•			•		•	•		•	•	•		•	•	•						



Birds

Species		Conservation status				Online DB's				Overlapping			< 10km							< 10km									
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W
ACANTHIZIDAE																													
Acanthiza apicalis	Inland Thornbill					•				•	•	•	•		•	•				•			•		•	•	•	•	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					•			•	•		•	•		•							•	•		•				
Acanthiza robustirostris	Slaty-backed Thornbill					•				•		•	•		•	•			•			•					•		
Acanthiza uropygialis	Chestnut-rumped Thornbill					•				•		•	•		•							•			•		•	•	•
Gerygone fusca	Western Gerygone					•			•	•	•	•			•	•			•	•		•	•	•		•	•	•	•
Pyrholaemus brunneus	Redthroat					•			•				•								•								
Smicronis brevirostris	Weebill					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•
ALAUDIDAE																													
Mirafr javanica	Horsfield's Bushlark					•						•	•	•					•								•		
ACCIPITRIDAE																													
Accipiter cirrocephalus	Collared Sparrowhawk					•				•	•	•														•	•	•	
Accipiter fasciatus	Brown Goshawk					•				•	•	•			•							•	•		•		•	•	•
Aquila audax	Wedge-tailed Eagle					•				•	•	•	•	•	•	•			•		•	•		•		•	•		
Circus assimilis	Spotted Harrier					•			•	•	•	•									•			•		•	•		
Elanus caeruleus subsp. axillaris	Black-shouldered Kite					•															•					•	•		
Haliastur sphenurus	Whistling Kite					•			•	•	•	•	•	•	•				•	•	•	•	•		•		•		
Hamirostra isura	Square-tailed Kite					•			•															•			•		
Hamirostra melanosternon	Black-breasted Buzzard					•			•		•	•										•		•			•	•	
Hieraaetus morphnoides	Little Eagle					•					•	•							•	•	•		•		•		•	•	•
Milvus migrans	Black Kite					•														•				•			•		
Pandion haliaetus	Eastern Osprey	MG	MI																					•					
ACROCEPHALIDAE																													
Acrocephalus australis	Australian Reed-Warbler					•																					•		
AEGOTHELIDAE																													
Aegotheles cristatus	Australian Owlet-nightjar					•				•	•	•	•	•		•			•	•	•	•		•	•	•	•		•
ANATIDAE																													
Anas gracilis	Grey Teal											•														•			
Anas superciliosa	Pacific Black Duck					•			•			•															•		
Chenonetta jubata	Australian Wood Duck											•																	
Dendrocygna eytoni	Plumed Whistling-Duck					•						•																	
ANHINGIDAE																													
Anhinga novaehollandiae	Australasian Darter											•																	
APODIDAE																													
Apus pacificus	Fork-tailed Swift	MG	MI			•	•	•			•									•									•
ARDEIDAE																													
Ardea modesta	Eastern Great Egret																							•					
Ardea pacifica	White-necked Heron					•																				•			
Ardea novaehollandiae	White-faced Heron					•				•														•		•			



Species		Conservation status				Online DB's				Overlapping			< 10km							< 10km															
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X					
<i>Ixobrychus flavicollis</i>	Black Bittern					•																													
<i>Nycticorax caledonicus</i> subsp. <i>australasiae</i>	Nankeen Night-Heron																										•								
ARTAMIDAE																																			
<i>Artamus cinereus</i>	Black-faced Woodswallow					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•					
<i>Artamus minor</i>	Little Woodswallow					•				•	•	•	•	•		•				•	•	•	•	•	•	•	•	•	•	•					
<i>Artamus personatus</i>	Masked Woodswallow					•			•	•		•	•								•		•		•	•	•	•							
<i>Cracticus nigrogularis</i>	Pied Butcherbird					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•					
<i>Cracticus tibicen</i>	Australian Magpie					•			•	•	•	•	•	•	•	•			•	•	•	•	•		•		•		•	•					
<i>Cracticus torquatus</i>	Grey Butcherbird					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•		•	•	•	•	•					
BURHINIDAE																																			
<i>Burhinus grallarius</i>	Bush Stone-curlew					•						•										•													
CACATUIDAE																																			
<i>Cacatua sanguinea</i>	Little Corella					•			•	•		•									•	•	•		•		•	•							
<i>Cacatua roseicapilla</i>	Galah					•			•	•	•	•	•	•	•	•			•	•	•	•	•		•		•	•	•						
<i>Nymphicus hollandicus</i>	Cockatiel					•					•	•										•	•		•		•	•	•						
CAMPEPHAGIDAE																																			
<i>Coracina maxima</i>	Ground Cuckoo-shrike					•			•	•	•	•									•	•							•	•					
<i>Coracina novaehollandiae</i> subsp. <i>subpallida</i>	Black-faced Cuckoo-shrike					•			•	•	•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•	•					
<i>Lalage tricolor</i>	White-winged Triller					•			•	•	•	•		•	•	•			•	•	•	•	•		•	•	•	•	•	•					
CASUARIIDAE																																			
<i>Dromaius novaehollandiae</i>	Emu					•				•		•	•		•						•			•		•	•								
CHARADRIIDAE																																			
<i>Charadrius veredus</i>	Oriental Plover	MG	MI				•																												
<i>Eelseyornis melanops</i>	Black-fronted Dotterel									•		•												•		•	•								
<i>Erythrogonyys cinctus</i>	Red-kneed Dotterel					•																													
CINCLOSOMATIDAE																																			
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush														•																				
<i>Psophodes occidentalis</i>	Chiming Wedgebill											•																							
CLIMACTERIDAE																																			
<i>Climacteris melanura</i>	Black-tailed Treecreeper									•				•												•									
COLUMBIDAE																																			
<i>Geopelia cuneata</i>	Diamond Dove					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•					
<i>Geopelia striata</i> subsp. <i>placida</i>	Peaceful Dove					•				•	•				•					•		•		•		•	•								
<i>Geophaps plumifera</i> subsp. <i>ferruginea</i>	Spinifex Pigeon					•				•	•	•		•	•	•	•		•	•	•	•		•	•	•	•	•	•	•					
<i>Ocyphaps lophotes</i>	Crested Pigeon					•			•	•	•	•	•	•	•	•			•	•	•		•	•	•	•	•	•	•	•					
<i>Phaps chalcoptera</i>	Common Bronzewing					•				•	•	•	•	•	•				•	•	•	•		•	•	•	•	•	•	•					
CORVIDAE																																			
<i>Corvus bennetti</i>	Little Crow					•			•	•											•	•				•									
<i>Corvus orru</i> subsp. <i>ceciliae</i>	Torresian Crow					•			•		•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•					
CUCULIDAE																																			



Species		Conservation status				Online DB's				Overlapping			< 10km								< 10km									
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
<i>Cacomantis pallidus</i>	Pallid Cuckoo					•			•	•	•	•	•	•	•	•			•	•	•				•	•	•	•	•	•
<i>Centropus phasianinus subsp. highami</i>	Pheasant Coucal					•																		•			•			
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo					•				•	•	•		•		•			•	•				•	•	•	•	•	•	
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo					•				•														•	•					
EUROSTOPODIDAE																														
<i>Eurostopodus argus</i>	Spotted Nightjar					•				•	•	•		•	•	•				•	•	•	•	•		•	•	•		
ESTRILDIDAE																														
<i>Emblema pictum</i>	Painted Finch					•				•	•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•	
<i>Neochmia ruficauda subsp. subclarescens</i>	Star Finch (Western)					•								•		•											•			
<i>Taeniopygia guttata subsp. castanotis</i>	Zebra Finch					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	
FALCONIDAE																														
<i>Falco berigora</i>	Brown Falcon					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	
<i>Falco cenchroides</i>	Nankeen Kestrel					•			•	•	•	•	•		•	•			•		•	•	•	•	•		•	•		
<i>Falco hypoleucos</i>	Grey Falcon		VU		VU	•		•						•					•											
<i>Falco longipennis</i>	Australian Hobby					•			•	•	•								•					•		•	•			
<i>Falco peregrinus</i>	Peregrine Falcon		OS			•		•		•	•	•														•				
HALCYONIDAE																														
<i>Dacelo leachii subsp. leachii</i>	Blue-winged Kookaburra					•					•	•								•			•			•	•	•		
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					•			•		•	•	•	•	•	•			•	•	•	•		•		•	•		•	
<i>Todiramphus sanctus</i>	Sacred Kingfisher					•						•							•					•		•	•	•		
HIRUNDINIDAE																														
<i>Cheramoeca leucosterna</i>	White-backed Swallow																							•		•				
<i>Hirundo neoxena</i>	Welcome Swallow																		•		•									
<i>Hirundo rustica</i>	Barn Swallow	MG	MI				•		•																					
<i>Petrochelidon ariel</i>	Fairy Martin					•						•	•							•	•						•			
<i>Petrochelidon nigricans</i>	Tree Martin					•				•		•	•		•					•	•					•	•	•		
MALURIDAE																														
<i>Amytornis striatus subsp. whitei</i>	Striated Grasswren					•			•	•	•	•	•	•	•	•				•		•	•		•	•		•	•	
<i>Malurus lamberti subsp. assimilis</i>	Variegated Fairy-wren					•			•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	
<i>Malurus leucopterus subsp. leuconotus</i>	White-winged Fairy-wren					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	
<i>Malurus splendens</i>	Splendid Fairy-wren					•			•			•	•		•				•		•	•								
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren					•				•	•	•		•	•	•					•			•				•	•	
MEGALURIDAE																														
<i>Eremiornis carteri</i>	Spinifexbird					•				•	•	•	•	•	•	•			•	•	•				•	•	•	•	•	
<i>Megalurus cruralis</i>	Brown Songlark											•															•		•	
<i>Megalurus gramineus</i>	Little Grassbird																										•			
<i>Megalurus mathewsi</i>	Rufous Songlark								•	•	•	•		•					•	•	•			•		•	•	•	•	
MELIPHAGIDAE																														
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	
<i>Certhionyx variegatus</i>	Pied Honeyeater					•						•									•			•					•	



Species		Conservation status				Online DB's				Overlapping			< 10km							< 10km											
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	
Conopophila whitei	Grey Honeyeater					•					•		•		•					•								•			
Epthianura tricolor	Crimson Chat					•					•	•							•		•	•	•		•	•	•	•		•	
Gavicalis virescens	Singing Honeyeater					•			•	•	•	•	•	•	•				•	•	•	•	•	•	•		•	•	•	•	
Lichmera indistincta	Brown Honeyeater					•			•	•	•		•	•	•	•			•	•	•		•		•	•	•	•	•	•	
Manorina flavigula	Yellow-throated Miner					•			•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	
Melithreptus gularis subsp. laetior	Black-chinned Honeyeater					•			•	•	•	•	•	•		•					•	•			•		•	•	•	•	
Ptilotula keartlandi	Grey-headed Honeyeater					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	
Ptilotula pencillata	White-plumed Honeyeater								•	•	•	•	•		•					•		•	•		•		•	•	•		
Ptilotula plumula	Grey-fronted Honeyeater											•																			
Purnella albifrons	White-fronted Honeyeater					•					•												•		•						
Sugomel niger	Black Honeyeater								•			•			•								•		•	•	•			•	
MEROPIDAE																															
Merops ornatus	Rainbow Bee-eater					•				•	•	•			•				•	•	•	•	•		•	•	•	•	•	•	
MONARCHIDAE																															
Grallina cyanoleuca	Magpie-lark					•			•	•	•	•	•	•	•	•			•	•	•	•	•		•		•	•	•		
MOTACILLIDAE																															
Anthus australis subsp. australis	Australasian Pipit					•					•		•		•					•	•	•			•		•	•		•	
Motacilla cinerea	Grey Wagtail	MG	MI				•																								
Motacilla flava	Yellow Wagtail	MG	MI				•																								
NECTARINIIDAE																															
Dicaeum hirundinaceum	Mistletoebird					•			•	•	•	•	•	•	•	•					•	•			•	•	•	•	•	•	
NEOSITTIDAE																															
Daphoenositta chrysoptera	Varied Sittella								•	•			•		•						•	•					•				
OTIDIDAE																															
Ardeotis australis	Australian Bustard					•			•	•	•	•			•				•	•			•		•		•	•	•		
PACHYCEPHALIDAE																															
Colluricincla harmonica subsp. rufiventris	Grey Shrike-thrush					•				•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	
Oreoica gutturalis	Crested Bellbird					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	
Pachycephala rufiventris subsp. rufiventris	Rufous Whistler					•			•	•	•	•	•	•	•	•			•	•	•	•		•	•		•	•	•	•	
PARDALOTIDAE																															
Pardalotus rubricatus	Red-browed Pardalote					•			•	•	•	•	•							•	•	•		•	•	•	•	•	•	•	
Pardalotus striatus subsp. murchisoni	Striated Pardalote					•			•	•	•	•	•	•		•				•	•	•	•	•	•	•	•	•	•	•	
PETROICIDAE																															
Petroica goodenovii	Red-capped Robin					•			•	•		•	•		•						•	•	•		•		•	•			
Melanodryas cucullata	Hooded Robin					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•	
PHALACROCORACIDAE																															
Phalacrocorax melanoleucos	Little Pied Cormorant					•																									
Phalacrocorax sulcirostris	Little Black Cormorant					•																				•	•				
PHASIANIDAE																															
Coturnix pectoralis	Stubble Quail																			•											



Species		Conservation status				Online DB's				Overlapping			< 10km							< 10km											
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	
Coturnix ypsilophora	Brown Quail					•						•							•			•	•		•			•			
PELECANIDAE																															
Pelecanus conspicillatus	Australian Pelican					•																									
PODARGIDAE																															
Podargus strigoides	Tawny Frogmouth									•	•	•		•		•			•		•		•	•				•	•		
POMATOSTOMIDAE																															
Pomatostomus superciliosus	White-browed Babbler					•				•		•			•						•		•	•				•			
Pomatostomus temporalis subsp. rubeculus	Grey-crowned Babbler					•			•	•	•	•	•		•	•			•	•		•	•		•	•	•	•	•		
PSITTACIDAE																															
Platycercus zonarius subsp. zonarius	Port Lincoln Parrot					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•		
Melopsittacus undulatus	Budgerigar					•			•	•	•			•	•	•				•	•		•	•	•	•	•	•	•		
Neophema elegans	Elegant Parrot										•	•																			
Neopsephotus bourkii	Bourke's Parrot								•		•		•	•					•		•										
Pezoporus occidentalis	Night Parrot	EN	CR		EN		•																								
Psephotus varius	Mulga Parrot					•														•	•	•		•	•						
PTILINORHYNCHIDAE																															
Ptilonorhynchus maculatus subsp. guttatus	Western Bowerbird					•				•	•	•	•	•		•			•	•	•	•		•	•	•	•	•	•		
RALLIDAE																															
Gallirallus philippensis	Buff-banded Rail																							•							
Porzana tabuensis	Spotless Crake					•																		•							
RECURVIROSTRIDAE																															
Himantopus himantopus	Black-winged Stilt											•									•										
RHIPIDURIDAE																															
Rhipidura albiscapa	Grey Fantail					•	•			•	•	•	•		•	•			•		•	•	•	•		•	•	•			
Rhipidura leucophrys subsp. leucophrys	Willie Wagtail					•			•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		
ROSTRATULIDAE																															
Rostratula benghalensis subsp. australis	Australian Painted Snipe	EN	EN	EN			•																								
SCOLOPACIDAE																															
Calidris acuminata	Sharp-tailed Sandpiper	MG	MI				•																								
Calidris ferruginea	Curlew Sandpiper	CR/MG	CR/MI		NT		•																								
Calidris melanotos	Pectoral Sandpiper	MG	MI				•																								
Tringa glareola	Wood Sandpiper	MG	MI									•																			
Tringa hypoleucos	Common Sandpiper	MG	MI				•																								
Tringa nebularia	Common Greenshank	MG	MI			•		•																							
STRIGIDAE																															
Ninox boobook	Boobook Owl									•	•	•				•					•	•	•		•		•				
Ninox connivens	Barking Owl					•																		•		•					
THRESKIORNITHIDAE																															
Threskiornis spinicollis	Straw-necked Ibis					•									•											•					
TURNICIDAE																															



Species		Conservation status				Online DB's				Overlapping			< 10km						< 10km																
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X					
Turnix velox	Little Button-quail					•				•	•	•		•		•			•	•	•	•			•		•	•	•	•					
TYTONIDAE																																			
Tyto alba	Barn Owl					•					•			•		•									•										



Reptiles

Species		Conservation status				Online DB's				Overlapping			< 10km							> 10km																	
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X							
AGAMIDAE																																					
Amphibolurus longirostris	Long-nosed Dragon					•			•	•	•	•	•	•	•	•			•	•			•		•		•	•	•	•							
Ctenophorus caudicinctus subsp. caudicinctus	Ring-tailed Dragon					•			•	•	•	•	•	•	•	•			•	•	•	•	•	•	•	•	•	•	•	•							
Ctenophorus isolepis subsp. isolepis	Crested Dragon					•			•	•	•	•			•	•			•			•			•			•		•							
Ctenophorus nuchalis	Central Netted Dragon					•																		•				•									
Ctenophorus reticulatus	Western Netted Dragon					•						•																•									
Diporiphora amphiboluioides	Mulga Dragon									•		•			•																						
Diporiphora valens						•			•			•	•		•	•																					
Pogona minor subsp. minima						•			•	•	•	•		•	•	•						•	•	•				•	•	•							
Tympanocryptis cephalus	Pebble Dragon				DD	•						•	•															•									
BOIDAE																																					
Antaresia perthensis	Pygmy Python					•					•	•	•									•		•	•			•									
Antaresia stimsoni	Stimson's Python					•						•		•	•								•		•			•									
Aspidites melanocephalus	Black-headed Python					•				•		•										•	•						•								
Liasis olivaceus subsp. barroni	Pilbara Olive Python	VU	VU			•	•	•				•								•								•		•							
CARPHODACTYLIDAE																																					
Nephurus wheeleri subsp. cinctus	Banded Knob-tailed Gecko					•					•	•												•			•	•	•								
Underwoodisaurus seorsus	Pilbara Barking Gecko			P2		•		•	•		•	•		•																							
CHELUIDAE																																					
Chelodina steindachneri	Flat-shelled Turtle											•																									
DIPODACTYLIDAE																																					
Crenadactylus ocellatus subsp. horni	Clawless Gecko					•						•												•	•	•		•									
Diplodactylus conspicillatus	Fat-tailed Gecko					•																		•			•	•									
Diplodactylus pulcher						•						•												•													
Diplodactylus savagei	Yellow-spotted Pilbara Gecko					•				•	•	•						•	•		•			•			•	•									
Lucasium stenodactylum	Pale-snouted Ground Gecko					•					•	•				•							•			•	•	•									
Lucasium wombeyi						•				•	•	•			•						•	•						•									
Oedura fimbria	Marbled Velvet Gecko					•			•	•	•	•	•	•		•			•	•	•		•	•	•	•	•	•	•	•							
Rhynchoedura ornata	Beaked Gecko					•			•		•	•							•				•				•										
Strophurus ciliaris subsp. aberrans																													•								
Strophurus elderi						•					•	•												•			•	•									
Strophurus jeanae						•						•												•			•										
Strophurus strophurus															•																						
Strophurus wellingtonae						•					•	•		•	•				•		•	•			•			•	•								
ELAPIDAE																																					
Acanthophis wellsii	Pilbara Death Adder					•			•			•			•						•								•								
Brachyuropsis approximans	North-western Shovel-nosed Snake					•					•	•											•				•	•									
Demansia psammophis subsp. cupreiceps	Yellow-faced Whipsnake					•					•	•			•						•	•		•		•	•	•									
Demansia rufescens	Rufous Whipsnake					•			•		•	•		•		•			•		•			•			•	•									
Furina ornata	Moon Snake					•			•		•	•							•	•	•			•				•									
Parasuta monachus	Inland Hooded Snake					•					•	•												•		•	•										



Species		Conservation status				Online DB's				Overlapping			< 10km							> 10km										
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<i>Pseudechis australis</i>	Mulga Snake					•						•									•			•	•		•	•		
<i>Pseudonaja mengdeni</i>	Western Brown Snake					•						•			•				•	•				•			•			
<i>Pseudonaja modesta</i>	Ringed Brown Snake					•					•	•			•									•			•			
<i>Suta fasciata</i>	Rosen's Snake					•				•	•	•												•						
<i>Suta punctata</i>	Spotted Snake					•																					•			
<i>Vermicella snelli</i>	Pilbara Bandy Bandy					•																		•						
GEKKONIDAE																														
<i>Gehyra pilbara</i>						•				•	•																	•		
<i>Gehyra punctata</i>	Spotted Rock Dtella					•			•	•	•	•	•	•	•			•		•	•	•	•	•	•		•	•		
<i>Gehyra purpurascens</i>						•					•													•				•		
<i>Gehyra variegata</i>	Tree Dtella					•			•	•	•	•	•		•	•		•		•		•	•	•	•	•	•		•	
<i>Heteronotia binoei</i>	Bynoe's Gecko					•				•	•	•			•	•			•	•	•			•		•	•	•		
<i>Heteronotia spelea</i>	Desert Cave Gecko					•			•		•	•			•	•			•		•	•			•		•		•	
PYGOPODIDAE																														
<i>Delma butleri</i>	Unbanded Delma									•		•			•									•				•		
<i>Delma elegans</i>	Pilbara Delma					•					•																	•		
<i>Delma haroldi</i>						•										•								•						
<i>Delma nasuta</i>						•			•		•	•			•	•							•	•			•			
<i>Delma pax</i>						•			•	•	•	•				•			•		•		•	•	•		•	•		
<i>Delma tincta</i>						•			•	•	•	•			•				•					•		•	•	•		
<i>Lialis burtonis</i>	Burton's legless lizard					•					•	•			•						•	•		•	•		•		•	
<i>Pygopus nigriceps</i>	Hooded Scaly foot					•									•			•									•	•		
SCINCIDAE																														
<i>Carlia munda</i>						•			•	•	•	•		•	•	•				•	•	•		•	•		•	•	•	
<i>Carlia triacantha</i>	Desert Rainbow Skink					•					•													•			•			
<i>Cryptoblepharus buchananii</i>						•						•								•				•						
<i>Cryptoblepharus plagiiocephalus</i>						•			•			•			•				•	•	•		•	•	•	•		•		
<i>Cryptoblepharus ustulatus</i>						•			•		•	•	•														•		•	
<i>Ctenotus ariadnae</i>																								•			•			
<i>Ctenotus duricola</i>						•			•	•	•	•		•		•								•			•			
<i>Ctenotus grandis</i> subsp. <i>titan</i>	Grand Ctenotus					•																		•			•			
<i>Ctenotus hanloni</i>										•																	•	•		
<i>Ctenotus helenae</i>						•			•		•	•			•	•		•		•			•	•			•	•		
<i>Ctenotus inornatus</i>									•																					
<i>Ctenotus leonhardii</i>						•				•		•			•												•			
<i>Ctenotus pantherinus</i> subsp. <i>ocellifer</i>	Leopard Ctenotus					•			•	•	•	•	•	•	•	•			•	•	•		•	•		•	•	•		
<i>Ctenotus piankai</i>										•																		•		
<i>Ctenotus robustus</i>						•																								
<i>Ctenotus rubicundus</i>						•			•	•	•	•		•		•					•		•		•			•	•	
<i>Ctenotus rutilans</i>	Pilbara Rusty Ctenotus					•				•								•										•		
<i>Ctenotus saxatilis</i>	Rock Ctenotus					•				•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•	•	•	
<i>Ctenotus schomburgkii</i>	Barred wedge-tailed Ctenotus					•			•	•		•			•	•					•									



Species		Conservation status				Online DB's				Overlapping			< 10km								> 10km																
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X							
Ctenotus serventyi						•					•	•														•	•	•									
Ctenotus uber						•						•																									
Cyclodomorphus melanops subsp. melanops	Slender Blue-tongue					•			•	•	•	•	•		•					•	•	•		•	•		•	•	•								
Egernia cygnitos	Pygmy Spiny-tailed Skink					•			•			•																									
Egernia depressa	Pygmy Spiny-tailed Skink					•				•	•	•		•		•						•							•	•							
Egernia formosa	Crevice Skink					•			•	•	•	•	•			•		•	•	•				•		•	•	•	•	•							
Egernia pilbarensis	Pilbara Skink																								•												
Eremiascincus fasciolatus	Narrow-banded Sand Swimmer									•	•	•						•	•					•													
Eremiascincus pallidus	Western Narrow-banded Skink					•			•																												
Eremiascincus richardsonii	Broad-banded Sand Swimmer					•			•		•	•													•		•										
Lerista bipes																								•													
Lerista labialis																											•										
Lerista macropisthopus								•																													
Lerista muelleri						•			•	•	•	•			•			•			•			•	•	•	•	•	•	•							
Lerista neander						•				•										•			•	•		•		•		•							
Lerista timida						•																					•										
Lerista verhmens	Powerful Lerista					•																															
Lerista zietzi						•			•	•	•	•		•		•							•	•	•	•	•			•							
Menetia greyii	Dwarf Skink					•			•	•	•	•			•	•		•			•		•	•		•	•	•	•	•							
Menetia surda subsp. surda						•						•																									
Morethia ruficauda subsp. exquisita	Fire-tailed Skink					•			•	•	•	•		•		•			•		•		•	•	•	•	•	•	•	•	•						
Notoscincus ornatus																											•										
Proablepharus reginae						•						•												•													
Tiliqua multifasciata	Central Blue-tongue					•			•	•	•	•		•	•			•		•	•			•			•	•									
TYPHLOPIDAE																																					
Aniliios ammodytes											•									•					•			•	•								
Aniliios ganei				P1		•		•	•		•										•				•		•		•								
Aniliios grypus											•	•												•			•	•									
Aniliios hamatus						•					•													•			•	•									
VARANIDAE																																					
Varanus acanthurus	Spiny-tailed Monitor					•			•	•	•	•		•	•	•				•		•			•			•	•								
Varanus brevicauda	Short-tailed Pygmy Monitor					•						•								•				•		•	•	•	•								
Varanus bushi	Pilbara Mulga Monitor					•			•	•	•	•	•			•					•	•			•			•	•	•	•						
Varanus caudolineatus	Stripe-tailed Monitor					•						•			•							•			•			•	•								
Varanus eremius	Desert Pygmy Monitor					•																		•			•										
Varanus giganteus	Perentie					•				•	•	•					•		•	•		•			•	•		•	•	•	•						
Varanus gouldii	Sand Monitor					•						•			•			•					•				•	•		•	•						
Varanus panoptes	Yellow-spotted Monitor					•				•	•	•	•	•		•			•					•	•	•	•	•	•	•							
Varanus pilbarensis	Pilbara Rock Monitor					•				•	•	•							•					•	•		•				•						
Varanus tristis subsp. tristis	Racehorse Monitor					•			•		•	•			•	•	•		•	•		•			•		•	•									



Amphibians

Species		Conservation status				Online DBs				Overlapping			< 10 km								> 10km											
		EPBC	BC	DBCA	IUCN	Nature Map	Protected Matters	DBCA threatened species	ALA	A	C	D	E	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W		
Amphibians																																
HYLIDAE																																
Cyclorana australis	Giant Frog								•																							
Cyclorana maini	Main's Frog					•			•	•	•					•		•	•		•			•		•	•		•			
Cyclorana platycephala	Water-Holding Frog					•												•														
Litoria rubella	Desert Tree Frog					•				•	•	•				•		•	•	•				•	•	•	•	•	•			
LIMNODYNASTIDAE																																
Neobatrachus aquilonius	Northern Burrowing Frog					•																										
Neobatrachus sutor	Shoemaker Frog					•					•							•														
MYOBATRACHIDAE																																
Pseudophryne douglasi	Gorge Toadlet					•					•													•			•					
Uperoleia saxatilis	Pilbara Toadlet					•					•													•		•	•					

Appendix C: Habitat Assessments within the Study Area

Site ID	Latitude	Longitude	Date	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Outcrop	Rock Type	Rock Size	Veg. Litter	Hollow Count	Last Fire	Disturbance
MA C-01	-22.8670	118.8352	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Silty Loam	Few Small Patches	Negligible	CID	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-02	-22.8669	118.8347	20/11/18	Minor Drainage Line	Minor Drainage Line	North	Low	Silty Loam	Many Large Patches	Negligible	CID	Small Rocks (11-20cm)	Many Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-03	-22.8663	118.8328	20/11/18	Minor Drainage Line	Drainage Area/Floodplain	Flat	Flat	Sandy Loam	Evenly Spread	Negligible	None Discernible	Pebbles (5-10cm)	Few Large Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-04	-22.8668	118.8324	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Silty Loam	Few Small Patches	Negligible	CID	Small Rocks (11-20cm)	Few Large Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-05	-22.8662	118.8295	20/11/18	Minor Drainage Line	Drainage Area/Floodplain	Flat	Flat	Sandy Loam	Evenly Spread	Negligible	None Discernible	Negligible	Many Small Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-06	-22.8658	118.8273	20/11/18	Minor Drainage Line	Drainage Area/Floodplain	North	Flat	Clayey Sand	Evenly Spread	Negligible	None Discernible	Negligible	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-07	-22.8668	118.8250	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Clay Loam	Few Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-08	-22.8649	118.8265	20/11/18	Hillcrest/Hillslope	Hillslope	South	Low	Silty Loam	Few Small Patches	Negligible	CID	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-09	-22.8643	118.8287	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Clay Loam	Few Small Patches	Negligible	None Discernible	Gravel (1-4cm)	Few Small Patches	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-10	-22.8650	118.8305	20/11/18	Hillcrest/Hillslope	Hillslope	South	Low	Silty Loam	Few Small Patches	Negligible	CID	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-11	-22.8646	118.8348	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Clay Loam	Few Small Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-12	-22.8992	118.8634	21/11/18	Hillcrest/Hillslope	Hillslope	South	Steep	Clay Loam	Few Small Patches	Limited Outcropping	BIF	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-13	-22.8916	118.8656	21/11/18	Hillcrest/Hillslope	Hillcrest/Upper Hillslope	West	Moderate	Clay Loam	Few Small Patches	Minor Outcropping	BIF	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	None Discernible
MA C-14	-22.8966	118.8638	21/11/18	Minor Drainage Line	Minor Drainage Line	South/East	Low	Clay Loam	Evenly Spread	Negligible	BIF	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-15	-22.8929	118.8675	21/11/18	Gorge/ Gully	Breakaway	East	Moderate	Clay Loam	Scarce	Major Outcropping	BIF	Small Rocks (11-20cm)	Few Small Patches	0	Old (6+ yr)	Other

Site ID	Latitude	Longitude	Date	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Outcrop	Rock Type	Rock Size	Veg. Litter	Hollow Count	Last Fire	Disturbance
MA C-16	-22.8954	118.8655	21/11/18	Hillcrest/Hillslope	Hillslope	South	Steep	Clay Loam	Many Large Patches	Negligible	BIF	Small Rocks (11-20cm)	Few Small Patches	0	Old (6+ yr)	None Discernible
MA C-17	-22.9025	118.8687	21/11/18	Drainage Area/Floodplain	Drainage Area/Floodplain	Flat	Flat	Clay Loam	Many Large Patches	Negligible	BIF	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-18	-22.8910	118.8642	21/11/18	Gorge/ Gully	Gully	South	Very Steep	Clay Loam	Many Small Patches	Moderate Outcropping	BIF	Small Rocks (11-20cm)	Many Small Patches	0	Old (6+ yr)	None Discernible
MA C-19	-22.8660	118.8229	20/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Clay Loam	Few Small Patches	Negligible	CID	Pebbles (5-10cm)	Scarce	0	Old (6+ yr)	Frequent Fire
MA C-20	-22.8892	118.8634	21/11/18	Hillcrest/Hillslope	Hillslope	West	Steep	Clay Loam	Scarce	Limited Outcropping	BIF	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-21	-22.9045	118.8688	21/11/18	Drainage Area/Floodplain	Drainage Area/Floodplain	Flat	Flat	Clay Loam	Evenly Spread	Negligible	None Discernible	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-22	-22.8935	118.8678	21/11/18	Gorge/ Gully	Breakaway	South	Cliff	Clay Loam	Scarce	Extensive Outcropping	BIF	Small Rocks (11-20cm)	Many Large Patches	0	Old (6+ yr)	None Discernible
MA C-23	-22.9075	118.8658	21/11/18	Drainage Area/Floodplain	Drainage Area/Floodplain	Flat	Flat	Loamy Sand	Evenly Spread	Negligible	None Discernible	Pebbles (5-10cm)	Scarce	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-24	-22.8947	118.8686	21/11/18	Hillcrest/Hillslope	Hillslope	South/ West	Moderate	Clay Loam	Few Small Patches	Negligible	BIF	Pebbles (5-10cm)	Scarce	0	Recent (0 to 2 yr)	None Discernible
MA C-25	-22.8668	118.8200	21/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Silty Clay Loam	Few Small Patches	Negligible	CID	Pebbles (5-10cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-26	-22.8960	118.8689	21/11/18	Drainage Area/Floodplain	Drainage Area/Floodplain	Flat	Flat	Sandy Loam	Evenly Spread	Negligible	None Discernible	Pebbles (5-10cm)	Few Small Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-27	-22.8686	118.8159	21/11/18	Hillcrest/Hillslope	Hillslope	North	Low	Silty Clay Loam	Few Large Patches	Negligible	CID	Gravel (1-4cm)	Few Large Patches	0	Moderate (3 to 5 yr)	Frequent Fire
MA C-28	-22.8971	118.8674	21/11/18	Minor Drainage Line	Medium Drainage Line	South	Flat	Clay Loam	Few Large Patches	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-29	-22.8989	118.8685	21/11/18	Hillcrest/Hillslope	Hillcrest/ Upper Hillslope	West	Moderate	Clay Loam	Few Small Patches	Minor Outcropping	BIF	Small Rocks (11-20cm)	Few Large Patches	0	Recent (0 to 2 yr)	None Discernible
MA C-30	-22.8988	118.8666	21/11/18	Hillcrest/Hillslope	Hillslope	West	Moderate	Silty Loam	Few Large Patches	Negligible	BIF	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire

Site ID	Latitude	Longitude	Date	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Outcrop	Rock Type	Rock Size	Veg. Litter	Hollow Count	Last Fire	Disturbance
MA C-31	-22.8942	118.8661	21/11/18	Gorge/ Gully	Medium Drainage Line	South/ East	Low	Clay Loam	Many Large Patches	Negligible	CID	Small Rocks (11-20cm)	Many Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-32	-22.9023	118.8648	21/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	None Discernible	Small Rocks (11-20cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-33	-22.8640	118.8203	20/11/18	Hillcrest/ Hillslope	Hillslope	North	Low	Clay Loam	Evenly Spread	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Cattle Grazing
MA C-34	-22.9030	118.8662	21/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-36	-22.9041	118.8648	21/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	CID	Small Rocks (11-20cm)	None Discernible	0	Recent (0 to 2 yr)	Frequent Fire
MA C-38	-22.8679	118.8228	21/11/18	Minor Drainage Line	Medium Drainage Line	Flat	Flat	Silty Loam	Few Large Patches	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-40	-22.8659	118.8217	21/11/18	Hillcrest/ Hillslope	Hillslope	North	Low	Silty Loam	Few Small Patches	Negligible	CID	Small Rocks (11-20cm)	Many Small Patches	0	Old (6+ yr)	Frequent Fire
MA C-42	-22.8648	118.8189	21/11/18	Hillcrest/ Hillslope	Hillslope	South	Low	Silty Loam	Scarce	Negligible	BIF	Small Rocks (11-20cm)	Scarce	0	Old (6+ yr)	None Discernible
MA C-44	-22.8657	118.8189	21/11/18	Minor Drainage Line	Medium Drainage Line	South/ West	Low	Silty Loam	Few Large Patches	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Old (6+ yr)	None Discernible
MA C-46	-22.8691	118.8116	22/11/18	Minor Drainage Line	Minor Drainage Line	North	Low	Silty Loam	Many Small Patches	Negligible	CID	Small Rocks (11-20cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-47	-22.8669	118.8113	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	CID	Gravel (1-4cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-48	-22.8688	118.8099	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South/ West	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-49	-22.8677	118.8099	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-50	-22.8697	118.8074	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	Flat	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Few Small Patches	0	Recent (0 to 2 yr)	Frequent Fire
MA C-51	-22.8710	118.8030	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South/ West	Flat	Clay Loam	Evenly Spread	Negligible	None Discernible	Negligible	Many Small Patches	0	Recent (0 to 2 yr)	Weed Invasion

Site ID	Latitude	Longitude	Date	Habitat Type	Landform	Aspect	Slope	Soil Type	Soil Availability	Outcrop	Rock Type	Rock Size	Veg. Litter	Hollow Count	Last Fire	Disturbance
MA C-52	-22.8712	118.8052	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	West	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Few Small Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-53	-22.8721	118.8010	22/11/18	Drainage Area/ Floodplain	Hillslope	South/ West	Low	Silty Loam	Few Small Patches	Negligible	BIF	Pebbles (5-10cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-54	-22.8711	118.8041	22/11/18	Drainage Area/ Floodplain	Minor Drainage Line	West	Flat	Clay Loam	Few Large Patches	Negligible	None Discernible	Negligible	Few Small Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-55	-22.8758	118.8004	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	Flat	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Many Large Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-56	-22.8729	118.8035	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	Flat	Flat	Clay Loam	Evenly Spread	Negligible	CID	Pebbles (5-10cm)	Many Large Patches	0	Recent (0 to 2 yr)	Weed Invasion
MA C-57	-22.8694	118.8060	22/11/18	Drainage Area/ Floodplain	Drainage Area/ Floodplain	South	Flat	Clay Loam	Evenly Spread	Negligible	None Discernible	Pebbles (5-10cm)	Scarce	0	Recent (0 to 2 yr)	Frequent Fire
MA C-58	-22.8687	118.8075	22/11/18	Drainage Area/ Floodplain	Hillslope	South	Low	Silty Loam	Few Small Patches	Negligible	CID	Pebbles (5-10cm)	Few Small Patches	0	Old (6+ yr)	None Discernible
MA C-59	-22.89268164	118.8672248	21/11/2018	Hillcrest/ Hillslope	Hillcrest/ Upper Hillslope	South	Moderate	Clay Loam	Scarce	Minor Outcropping	BIF	Pebbles (5-10cm)	Many Small Patches	0	Recent (0 to 2 yr)	None Discernible

Appendix D: Cave Attributes

Cave ID	Latitude, Longitude	Date Assessed	Roost Type	Cave Position	Floor Slope	Aspect	Cave Exposure	Entrance Type	Entrance Shape	Entrance Width (m)	Entrance Height (m)	Water Present	Scat Count	Count/ Estimate	Scat Age	Comments	Photo
CMAC01	-22.892673, 118.867215	21/11/2018	Potential Feeding Roost	Mid Slope	Declined	West	Semi exposed	Cavity	Vertical	2	16	Not Accessed	Not Accessed	Not Accessed	Not Accessed	Not entered. Crack / sink hole	